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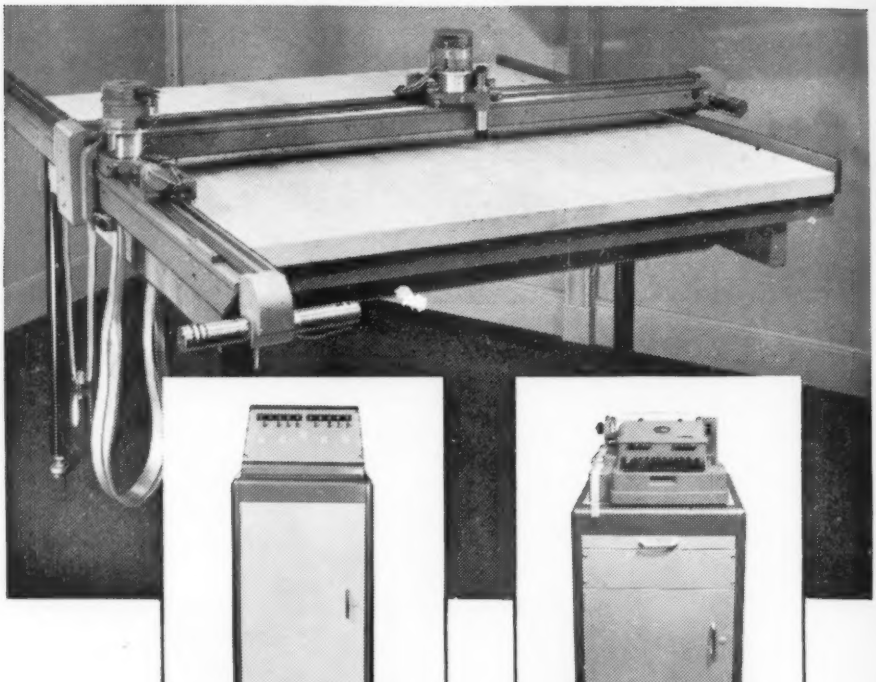

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Editor-in-Chief
Howard S. Rappleye

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The Role of the Land Surveyor (Past, Present, and Future) in Urban or City Land Planning

(A Panel Discussion)

PANEL ON "THE ROLE OF THE LAND SURVEYOR (PAST, PRESENT, AND FUTURE) IN URBAN OR CITY LAND PLANNING"

Left to right: W. J. Reese, W. H. Matheny, A. Phillips Bill, C. C. Lindsay, A. D. Shaw, and C. J. Aggeler.

EDITOR'S NOTE.—The panel discussion and forum presented below constituted the feature of the plenary session sponsored by the Property Surveys Division at the Twentieth Annual Meeting of the American Congress on Surveying and Mapping at Washington, D. C., on March 22, 1960. A. Phillips Bill, Chairman of the Property Surveys Division, presided and presented the introductory remarks. The panel was composed of the following, all members of the committee appointed last year to investigate and report on the position of the surveyor with regard to town and city planning:

W. H. Matheny, Chairman of the "Planning" Committee of the Property Surveys Division; a surveyor in private practice in Charleston Heights, South Carolina.

W. J. Reese, Second Vice Chairman, Property Surveys Division; an engineer in private practice in Rock Island, Illinois.

C. C. Lindsay, a member of the Advisory Council of the ACSM; a Quebec land surveyor and civil engineer with private practice in Montreal.

Arthur D. Shaw, a surveyor in private practice in Jamaica, New York.

Prof. C. J. Aggeler, an instructor of surveying at City College of San Francisco; a surveyor and engineer in private practice.

MR. BILL: For many years now, wherever and whenever surveyors meet, in large groups or small and for whatever the purpose, one of the most acrimonious subjects of debate has been the general relationship between the surveyor, the engineer, the architect, and a sometimes—but not always—nebulous figure called the planner, on the one hand, and the public interest which all should serve, on the other.

To some surveyors, the planner appears, as you might say, to be a fiend incarnate with the French curve rampant; to others, the words planner and surveyor are synonyms; to many others, they imply a well organized team effort in the interests of the land itself by all the professional persons cited already and with the help of many others.

To bring this problem out into the open, to see where the surveyor stood in it, and, eventually, to suggest a course for future activity on our part, the Property Surveys Division last year appointed the committee which you see before you to bring in a report.

W. H. MATHENY DESCRIBES CONDITIONS IN THE SOUTHEAST

MR. MATHENY: Inasmuch as this committee has been chosen from the various geographic areas of the North American continent, my report will deal primarily with the conditions I have found in the geographic area in which I practice—namely, the Southeastern United States. I realize that, in some areas, land planning has been practiced for a much longer period than in the area from which I gathered information and opinions to compile this report. Perhaps one of the reasons for our problems is that we are still suffering from growing pains, insofar as planning regulations and administration are concerned.

The opinions set forth in this report have been derived from considerable information gathered from various areas throughout the Southeastern States and from personal contact with those familiar with the problems under consideration.

The property surveyor must accept at least a part of the responsibility for the development and growth of the various planning boards and commissions throughout the country today. Little as we may care to admit this responsibility, it has been, I regret to say, carelessness and lack of planning on the part of the surveyor in the past that has resulted in a period of planning boards and commissions which are primarily of a political nature. In the past, a surveyor enjoyed more or less complete freedom in the planning and subdividing of property. I would say that the majority of those engaged in survey work in the past have done a good job of planning. Many have done a wonderful job. However, there have been a few who have been careless and irresponsible. To quote Shakespeare's Mark Antony: "The evil that men do lives after them; the good is often interred with their bones." So it is with the surveyor. We hear nothing of the well planned subdivision of property by the surveyor in the past. All we hear is the evil that men do. I have been fortunate to have practiced both in the period prior to planning boards or commissions and within their realm. The surveyor practicing without a planning board looking over his shoulder enjoys a freedom of operation in that he has only to satisfy his client; however, sometimes the surveyor has not considered the effects on others of what he was doing for his client. Although, after all, his client's interests must be his first consideration, he must also consider what effect his work might have on adjoining property owners and, in all possibility, future operations of his own client. A man's personal liberties end when they reach the point of encroaching upon another person's liberties. Therefore, although I am of the opinion that the surveyor has been partly responsible for the growth and development of planning boards and commissions, it must be said, in all fairness to the surveyor, that on the whole he has operated within the influence of the time in which he practiced.

The surveyor today stands at the crossroads. His practice is endangered to the point of his becoming a subprofessional through the dictates of career planners. I point out the words "career planner" as a concession to our esteemed Secretary, Victor Ghent, who quite emphatically resented the words "professional planner." I will have to say that I entirely agree with him, because land planning, to my knowledge, has never been recognized and licensed by any State. The career planner is a dreamer. He would plan all of the city, the county, the State, the United States, and the whole World, and he would, too, if someone would give him the authority. The only trouble is that some of his plans for development of a piece of property are impossible to establish on the ground. If the career planner were granted enough authority, he could, in his opinion, plan a Utopia.

In many areas, the surveyor today is denied the privilege of planning his subdivision. I have found that surveyors practicing today are given to three categories and three viewpoints of land planning. The first is the surveyor practicing in an area not subject to supervision by a planning board or commission. This surveyor, to me, has shown little interest in our prob-

lem. The second is the surveyor practicing in an area in which a new planning body dictates to a great extent his actions in the field. This man generally has reached a state of professional frustration. The third and most important category is the surveyor who has worked with a planning board or commission in his area long enough to realize what we are faced with today and the effect on his future. This surveyor is the one most anxious to do something about this situation.

I think we all realize that land planning is here to stay and, with the requirements of the FHA and VA being what they are, the surveyor must become active in land planning. It has been my personal experience, and the experience of those whom I have questioned on this matter, that our problem lies not in the regulations governing land planning, but in the administration of these regulations. If land planning is to be successful, it must be administered by those experienced in field work as well as the theory of land planning. We all realize that land planning is an integral part of land surveying; but, today, the surveyor is fast being relegated to a role of subprofessional work through the political activity of the career planner.

To predict the surveyor's role in planning in the future lies somewhat within the realm of fortune telling; however, there are certain factors which point the way in which the surveyor's role will be affected, if not influenced by outside forces.

In general, the surveyor has remained aloof from politics and, in so doing, has allowed his professional status to be undermined by those with political influence. If the surveyor is to maintain his professional stature and if he is to increase this professional stature, he must take an active part in developing legislation which will afford him professional protection.

It is a well known fact that the career planners are good as politicians. As I mentioned earlier, they promise the people that through their efforts and by following their advice they will live in a Utopia. It is also well known that any profession must keep abreast of progress or it loses its professional standing and becomes relegated to a subprofessional or technician level. Adequate land planning must become a part of the surveyor's work.

I am not against land planning. However, I believe that those engaged in land planning should first qualify as surveyors. As you all know, there is a concerted effort on the part of planning officials to achieve professional recognition by examination and registration by the various States. If this is allowed to become a fact, without qualifying the registrant on his ability to actually survey the property of which he plans development, then the surveyor will become merely a subordinate, a subprofessional, obeying the dictates of the licensed professional planner. I do not contend that adequate land planning is undesirable. I do, however, contend that land planning must be done by a person qualified in all phases of planning. The person most qualified to practice land planning is the surveyor who has intimate knowledge of the property lines, area, and topography of the property under consideration and a general knowledge of the same facts on the adjoining property.

As I said earlier, the surveyor, in general, has shied away from political involvements; however, it now becomes apparent that, in order to protect his future professional standing, the surveyor must engage in politics to the extent of promoting protective legislation. This cannot be on a national level by the American Congress on Surveying and Mapping, but must be fostered and developed by its local chapters and affiliates. The fact that we meet here today in an attempt to study the surveyor's acts in the past, understand his problems of today, and look into his role in this work in the future, is not going to solve the problem. Some of us—and the more working at it the easier it will be—are going to have to put forth the effort necessary to insure the professional standing of the surveyor in the future. On this point I would like to quote—I believe it was Theodore Roosevelt: "Every man owes some of his time and effort to the uplifting of his profession."

W. J. REESE URGES ACTION BY SURVEYORS

MR. REESE: In the early days of the development of the United States, the land surveyor was considered as one of the leading professional men in the community. As such, his advice was sought on the development of the land, establishment of legal boundaries, and subdivision of land. At this time there were no license laws in effect, with the result that many unqualified persons began the subdividing of land. Many of these subdivisions were paper plats only; in many cases they did not fit the actual legal boundaries. In retracing many of these early surveys, one wonders how these people were able to do accurate work with the equipment available at the time. Most of the early surveyors did excellent work. Much of what is criticized concerning surveys made previous to enactment of our license laws can be traced to work done by men not qualified in the field of surveying.

As the population expanded, the necessity for land and city planning became evident. State laws were passed setting up the mechanics for the establishment of planning departments in the cities and counties of the State. Master plans and subdivision planning ordinances were proposed by planning agencies under which the surveyor had to operate. At this point the surveyor's problems began in many areas of practice.

Through the years the land surveyor has acted as the advisor to the landowner and as the liaison between the owner and the proper civil authorities. With the advent of planning departments, city and county regulations were established which required the approval of the boundaries, lot sizes, streets and street improvements, sanitary facilities, and so forth.

Where a man was practicing land surveying only, this put him at a distinct disadvantage, because approval could not be obtained unless the engineering requirements were complied with. Under many of our State laws, a registered engineer is not permitted to certify to a survey or a plat of subdivision. This is true in Illinois and Iowa.

The surveyor has been, to a great extent, responsible for the development of city planning in this country. The surveyor has kept himself under a bushel basket while the other professional men have been passing him by at a rapid pace. He did not take his rightful place and assert himself. In many cases he failed to keep abreast of new techniques and research in planning, and failed to obtain membership in civic committees, with the result that, today, most planning commissions do not have a land surveyor on the commission or advisory to it.

In the Midwest area you can divide the surveyors into two classes—those that practice in the metropolitan areas and those that practice in the rural sections. I have discussed the matter of planning with representatives of both classes and find that the majority of surveyors favor land planning but feel that many changes are required in the ground rules.

For many years the surveyors in the metropolitan areas have done research and have been doing an excellent job of subdivision planning, residential and industrial.

There is, however, considerable criticism of planning departments and commissions as they are now operating, the most prevalent criticism being the lack of experience on the part of the planning engineers employed by the commissions. They lack experience, proper fundamental training, knowledge of land surveying and law, and many "have their heads in the clouds." Many planning ordinances are not workable as adopted. They ignore legal survey requirements and do not fall within the legal framework of the State laws. Recently, in discussing a proposed planning ordinance with the planning consultant hired by a city, I questioned the legality of certain provisions. The consultant stated: "We do not care what the law says. We write into the ordinance what we feel should be in the ordinance and most people will be led like a dog on a leash."

In many States we are protected by statute, but if we are to maintain our professional standing, we must be on the alert so that adverse legislation is not passed. We must promote legislation that will bene-

fit and protect the land owner as well as the surveyor.

I am personally in favor of land planning, but feel that we must make every effort to get mutual cooperation between the planners and the surveyors. I do not think it is necessary for the planner to be a surveyor, but he should have a good fundamental knowledge of land surveying. The land planner should be licensed the same as the surveyor and he should be entitled to become a land surveyor if he can pass the necessary examinations and fulfill the qualifications required by the surveyor's act in the State in which he is practicing.

Many of our land planning consultants are not members of the engineering or surveying professions. They have little knowledge of the laws pertaining to land. The land planner must deal with legal boundaries, topography, street improvements, sanitation, water supply, human relationship, building and architectural details, ownership, municipal law, and so forth. It is quite evident, then, that proper planning of land should be based on a professional knowledge of (1) land surveying, (2) law, (3) civil engineering, and (4) architecture.

We, as surveyors, must broaden our technical knowledge, assert our position in the community, and take a more active part in city planning.

C. C. LINDSAY REPORTS ON CONDITIONS IN CANADA

MR. LINDSAY: I have been asked to present a paper upon the subject of "The Role of the Land Surveyor (Past, Present, and Future) in Urban or City Land Planning" insofar as this subject concerns Canada, your neighbour to the north. The Dominion of Canada is a vast area comprising ten Provinces and some Territories, each of the Provinces having its own corporation or association of land surveyors, some particular laws of its own, and its own problems with regard to town or community planning. But the situation is more or less the same in each one of them with regard to the role to be played by the land surveyor. I will therefore deal mostly with conditions in Quebec Province.

In the past, before the present burst of population, in what are popularly called the "horse and buggy days," the land surveyor was the only town planner in Canada. That is, he laid out the subdivisions and the proposed villages and towns upon his own design, based upon his skill and experience and his influence upon the owner. Altogether too often the owner had some ideas of his own, which did not always conform to what was right, either technically or topographically. On the whole, the land surveyor did a good job. In the very first days, the tendency was to lay out streets that were too narrow, but there were reasons for this inasmuch as public utilities were at a minimum, there were extremes of climate, and there were all too frequent alarms of war, all of which tended to make a community compact and self-supporting. Later on, modern legislation provided that no street in a subdivision should be less than 66 feet, i.e., one Gunter's chain, in width.

From the beginning of the century until some twenty-five years ago, the land surveyor was still supreme in town planning. It is well to emphasize here that in all Provinces of Canada, the land surveyor alone can prepare and register subdivision plans, or, in fact, prepare any plans whatsoever relating to the title or identification of land. The method of subdivision followed in most cases was the rectangular system, which is coming in for a lot of criticism today, just and unjust, but it served the needs of the times which called for rapid development at minimum cost.

During this period, there was little municipal control of town planning. In "boom" periods, when the pressure from land speculators and builders was on, many subdivisions were laid out with lots too narrow. In some instances, not enough space was left between projects to ensure proper spacing for streets and blocks therein. Unscrupulous land owners, out to get the maximum number of lots, laid them out with a minimum width and depth and as few streets as possible.

In rural areas, some of our good farmers were selling building lots on their land which they would mark out themselves upon

the ground, using whatever unit of measurement was available—a measured length of rope or a measured pole. The deeds of sale were passed accordingly. To get around the regulation covering street width, they would grant servitudes or easements upon strips of land of relatively narrow width to serve the plots of land thus sold. Fortunately for all concerned, this condition of affairs was of very short duration, as the Provincial Government passed the necessary legislation authorising municipalities to enforce proper cadastration of these areas and a proper layout. Unfortunately for the surveyor in these cases of owner-dominated subdivision, he is the one who gets the blame for these freak subdivisions, as it is his name which appears on the plan.

At present, conditions are under better control. All of our large cities have their town planning departments with registered land surveyors on their staffs. No subdivision plans may be registered unless approved by the municipalities in which they are situated. Subdivisions which include streets of lesser width than 66 feet, as well as any subdivision plans of a bizarre nature, have to be approved by the Provincial Department of Municipal Affairs. In addition, all subdivision plans have to be approved by the Cadastre Service of the Department of Lands and Forests before being passed on to the registry office of the district or county concerned.

Now, what is the role of the land surveyor with regard to town planning at the present time in Canada? As previously mentioned, no plan can be registered without his signature. By so doing, he takes the responsibility. This means, as a minimum, that he must measure the property, lay out the lots, calculate their areas, then prepare the plan and the book of reference, which is a written description of each lot and accompanies the plan to be registered.

We have a number of town planners in Canada, some of them very good, some of them not so good, the same as elsewhere. They have no professional standing, as such. Usually their activities are confined to the drawing of the theoretical plan, leaving it to the surveyor to lay out the lots on the ground and do the mathematical work connected therewith. Many surveyors are members of town planning groups and associations. Their membership in such organizations is to be encouraged.

A few years ago a seminar was held near Montreal for the purpose of studying this whole problem of town planning. It was attended by municipal engineers, land surveyors, architects, town planners with and without university training, and civic employees who were interested in urban development. A member of each profession was chosen to lecture, for one day, upon the part which his particular calling played in the development of a city. Each lecture was followed by a long discussion period. I had the privilege of representing the land surveyors thereat, although I am also a practising municipal engineer. This seminar was one of the most interesting that I have ever attended because it was a case of mutual self-education for all of us. The conclusion which I reached then, almost fifteen years ago—and I have learned nothing since to make me change my opinion—is that this problem of town planning is a joint affair. First of all, a general plan is required, showing boundaries, dimensions, bearings, and contours and other topographical features. This is the land surveyor's work. Next is a theoretical layout of lots based upon topography. This can be done by the land surveyor (he has been doing it for generations and can adapt himself to modernisation) or by the town planner. Then the street layout must be checked by the municipal engineer for grades, sewer locations and run-off, water supply, pavements and sidewalks, and power lines. The architect comes into the planning for design of proposed buildings and their siting upon the lots. The surveyor, town planner, engineer, and architect come together for zoning regulations. Finally, there is the preparation of the completed plan, with dimensions, areas and lot numbers of building sites, and their registration and description for title, which, as previously mentioned, is solely land surveyors' work.

All too many of our town planners who are not members of the engineering or sur-

veying profession seem to go off the deep end in their proposed layouts. One not infrequently forms the impression from some of the designs submitted that the design with the greatest number of curves of every kind—simple, compound, reversed—is the most assured of first prize. From the surveyor's point of view, the more curves there are, the more money there is in it for him, because calculating multi-curved layouts is expensive, but it is hard on the client. The writer is in agreement that curved side streets are pleasing and cut down traffic hazards, but he is of the opinion that tangents should be substituted for all curves of two degrees or less, also that stretches of tangent should be placed as frequently as possible between curves to enable these to be anchored down for reference purposes for restaking property boundaries later. Again, there is an inordinate tendency toward dead-end streets, notwithstanding the delays offered to operations of snow-clearing, fire-fighting, everyday deliveries of provisions and merchandise, and the danger of being bottled in by repairs to pavements, sewers, or water mains, or by ordinary street accidents. The water supply is always better and safer if the lines are laid in closed loops. Again, numerous sharp curves increase the cost of building sewers by multiplying the number of manholes required.

Summarized from the above, it would seem to me that, if the land surveyor wishes to maintain his position as a leader in town planning, he will have to broaden his education in this field to include theoretical layout practises based upon modern principles. If he is also a civil engineer, his position will be reinforced all the more as he can advise from a municipal engineering point of view. The role of the architect, as such, while quite strong some few years ago, is dwindling in the field of theoretical layout; those architects who are doing this work are acting more in the role of town planner than otherwise. It is possible, however, that they have found that the returns therefrom are not comparable with the fees which are normally obtainable in the field of building design in which they are supreme. To quote from a speech by Prof. James A. Murray, printed in the Journal of the Royal Architectural Institute of Canada in February 1959, "We sent out a questionnaire to find out what would interest the architect and what matters would bore him. Absolutely at the bottom rating in interest were two subjects—student work and town planning."

Last spring our Town Corporation of Quebec Land Surveyors sent out a questionnaire to Quebec land surveyors. The following tabulation gives some of the important questions asked and the numbers of affirmative, negative, and "no opinion" replies to each:

	Yes	*No*	*No Opinion*
Are you interested in town planning?	100	2	2
Is the surveyor occupying his proper place in town planning?	46	55	1
Do you believe that the surveyor can regain his position in this field?	88	5	9
Are you practising town planning?	78	17	7
Do you belong to any town planning group, municipal, parochial, or other?	42	58	2
Do you consult with town planners or other professional specialists in special cases?	55	44	3
Do you believe that the land surveyor is sufficiently trained in town planning to undertake large-scale work in this field?	14	77	11
If special courses in town planning were given locally, would you follow them?	68	26	8
Are you interested in receiving literature on town planning?	91	9	2
Do you consider the basic education of the surveyor as being equal to that of any other profession, relative to town planning?	78	15	7
Are you of the opinion that town planning, as practised now, infringes upon the prerogatives of the surveyor, or that the confusion caused by the practicing of town planning by nonprofessionals is detrimental to surveyors?	90	6	6
Would you join any professional organization which			

would group various professional specialists in town planning?	83	15	4
Would you agree to pay a special contribution as a member of a corporation of professional town planners?	88	11	3

The above figures speak for themselves. Under present conditions, because there is no restraint upon the use of the words "town planner," anyone can call himself such with subsequent abuses and loss of professional standing to all connected with any scheme of doubtful character. It would be a great step forward if the surveyors themselves could undertake the formation of a properly licensed legal body, bearing always in mind that membership in such an organization must not carry the right to practise either engineering or land surveying contrary to the Civil Engineers Act and the Quebec Land Surveyor's Act, both of which set forth the respective prerogatives of these professions.

A. D. SHAW DESCRIBES THE SURVEYORS ROLE IN LOWER NEW YORK STATE

MR. SHAW: I have been asked to report on the surveyor's role in planning, as this subject pertains to my area, which is Queens County, Long Island, and adjacent areas in New York State.

Queens County is one of the five counties which comprise the City of New York. It became part of the city in 1898. It has grown from a rural farming county in 1920 into a thriving community of over 1½ million residents today. Between the years 1920 and 1945, hundreds of thousands of new one-family houses were built. With the advent of rapid subway transportation to Queens from the heart of New York City, many of these areas are now being again transformed by the erection of two- and three-story garden apartments and six- and twelve-story apartment houses.

What has been the surveyor's role in this?

My firm, which was established in 1852 in Jamaica in the center of the county and has been in continuous existence since, has had a part in the planning, expansion, and growth of the county. The founder of the firm, E. W. Conklin, was also the village engineer. One of our predecessors, J. J. McLaughlin, was the county engineer until we became part of the City of New York. Another, Mr. Crowell, was Chief Engineer of the Topographical Bureau of the Borough of Queens for many years. My partner, Mr. Erlandsen, served as Chief Engineer of the Borough of Queens.

In the early days, farms were subdivided into building lots without much planning. Many subdivisions were made for real estate speculators and for lot sales by owners. The owners would insist upon the surveyor getting the most lots possible out of the acreage. There are filed maps showing lot frontages of 14 feet, depths of less than 100 feet, and street widths of 20, 30, and 40 feet. In many cases, no thought was given to topography, drainage, or the rights of adjacent owners.

After 1905, filed maps had to agree, at least approximately, with a tentative street system map approved by the Topographical Bureau of the Borough of Queens, or amendments thereto. Between 1910 and 1920, most of the county was "final mapped" by the Topographical Bureau. Thereafter, any land subdivision maps had to agree with these final maps. However, most of these final maps specified a rectangular street system. In many cases this was not the best or the most economical layout because of the nature of the terrain.

In cases where the owner was willing to bear the additional expense, we have laid out many curvilinear subdivisions. In time, these have become very high class residential communities, as the natural contours, trees, and so forth have been preserved.

However, before he can file a map showing departures from the approved street plans, the surveyor must convince the Borough authorities and the New York City Planning Commission that his layout is better than the one already adopted on the final maps.

Nassau and Suffolk Counties, adjacent to Queens County, have also grown very rapidly in the last thirty years. Most townships in these counties have their own town planning boards and each county has a county planning board.

The town planning boards now set the minimum requirements for subdivisions, specifying size of plots, width of streets, grade of streets, degree of curve of streets, method of setting monuments to hold alignment of streets, type of street pavement, and drainage and sanitary facilities. At present, all subdivision maps must be approved by these planning boards before they can be filed. The owner must post a bond that the subdivision will be built according to these standards.

Most of these town planning boards have a consultant who is a professional engineer and land surveyor. The county planning boards have some professional engineer and land surveyor members. The present elected county executive of Suffolk County is a professional engineer and land surveyor and is a very well qualified man.

We have always received the utmost of cooperation from the engineers of the Borough and from the planning commissions. We assume this will be so in the future and, therefore, the surveyors in Queens County and adjacent counties have no serious problem in this respect, except with relation to drainage and sanitary facilities.

At the present time, there is a proposal being set forth to revise the building code of the City of New York and to rezone the entire city. This presents many problems. In many places it would up-grade property. In others, it would down-grade property, practically amounting to confiscation without due process of law.

The surveyor must be awake to these problems, as they also affect the over-all economic condition of the community. Therefore, he must be ready and willing to serve on committees, commissions, and planning boards, wherever he is needed.

The educational requirements of the future surveyor should include land planning and drainage, etc., so that he may competently prepare and file modern subdivision maps and do all the necessary engineering work incidental thereto. He will then be prepared to serve on these boards and commissions as a fully qualified professional man. If this is not done the surveyor will be relegated to a subprofessional role.

Each planning board should have at least one surveyor member. The surveying profession should insist upon this for the welfare of the general public and for its own future professional status.

C. J. AGGELER OUTLINES THE SITUATION IN CALIFORNIA

PROFESSOR AGGELER: In discussing the role of the surveyor in land planning, I must, of necessity, limit my remarks to conditions in the State of California, although conditions appear to be similar in varying degrees throughout the western United States.

Someone better qualified than I could narrate the factual history of surveying in California, but it is my impression that a considerable number of land surveyors in the past limited their practice to land surveying in its strictest sense. Today, the typical surveyor not only establishes and retraces boundaries, but is also engaged in subdivision surveying and planning, control surveys, and engineering project surveys. The California Land Surveyors' Act includes in the definition of land surveying all types of surveying, including geodetic, and restricts the surveyor only in that he may not design any structures or fixed works. We have, in California, a strong organization of land surveyors and civil engineers practicing land surveying which has accomplished a great deal in raising the standards of surveying practice. I believe that this organization would not be in existence today had it not been necessary to organize for union bargaining, brought about by this broad practice of surveying which includes construction surveys.

The fact that we have both land surveyors and civil engineers practicing land surveying in California may need explanation. The Land Surveyors' Act defines land surveying and provides for the licensing of surveyors authorized to practice it. The Civil and Professional Engineers' Act provides for the registration of civil engineers and includes in the practice of civil engineering,

land surveying as well as city and regional planning insofar as the usual civil engineering practice is concerned therein.

Land planning by the California surveyor is integrated with the work of the planning commissions. Perhaps some surveyors would prefer that I say that their planning is hampered by the work of the commissions, but I will have more to say about this later. The California Planning Law is the legal authority for the establishment of these commissions. By ordinance, the legislative body of each city may, and of each county shall, create a planning commission. A planning department may also be created. The members of the planning commission are appointed by the governing bodies. The planning commission may appoint a director of planning and employees it deems necessary, subject to civil service regulations. The planning commissions may also employ or contract with planning consultants or other specialists for such services as they require. The Planning Law also provides for the establishment of regional and area planning commissions. These various planning commissions are responsible for the preparation of master or general plans to be adopted by the legislative body as the basis for the physical development of the city, county, area, or region. These planning commissions may, from time to time, or if so directed by the legislative body shall, prepare precise plans governing land use based on the master plan. In addition, the legislative body may, and usually does, designate the planning commission as the advisory agency with respect to the approval of subdivision maps.

In California, the State Map Act sets up the general rules for subdivision procedure and local ordinances specify the detailed procedure. Control of the design and improvement of subdivisions is vested in the governing bodies of the cities and counties. The cities control all areas within their boundaries and the counties control all the unincorporated areas. Every county and city must adopt an ordinance regulating and controlling the design and improvement of subdivisions. The subdivider, usually represented by the surveyor, must file a tentative map with the advisory body. As already noted, this is usually a planning commission. The governing body may authorize the advisory agency to report approval, disapproval, or conditional approval of the tentative map directly to the subdivider, or it may act upon the recommendation of the advisory body and report to the subdivider. A final map must be made in accordance with the tentative map as approved and the subdivision survey and final map must be made by a registered civil engineer or a licensed land surveyor. After legal procedures specified in the map act and local ordinances are complied with, the map is recorded.

The preceding brief discussion may help to show why and how the California surveyor is involved in subdivision planning. As explained to me by one engineer, many of our present day subdivisions are of such magnitude that they are small cities and must contain all the necessary elements of city planning.

Now, I would like to give you my impressions concerning the thinking and action of our surveyors in land planning as I have gained them from questionnaires, direct conversation, and personal observation. A small but representative sampling of private surveyors in California by questionnaire gives some indication of the role of the surveyor in land planning. Practically all of those questioned are licensed land surveyors or registered civil engineers and the majority are engaged in subdivision planning, with a few concerned with city and regional planning. They all believe that the land planner should be a professional man, but they do not agree as to whether he should be a licensed land surveyor or a registered engineer or if he should hold a degree in land planning. Only one-third of this group felt that the land surveyor should qualify as a land planner or that he must do so to survive. Some of this disagreement is undoubtedly due to a lack of a clear definition of land planning and to attempts to group all planning into a single category. This problem and the necessity of a differentiation are clearly indicated by one of our engineers who is engaged in subdivision

work of considerable magnitude, when he states: "Part of the problem of planning is one of definition. Land planning or site planning of specific land areas without a knowledge of surveying and civil engineering is technically impossible though frequently attempted. City planning or regional planning which concerns itself only with the broad aspects of land use, density, and other related problems may be handled successfully by those trained as planners without a knowledge of surveying or engineering, although this knowledge is of invaluable help." There is considerable criticism of planning commissions which must judge the technical work of the surveyor and engineer in subdivision planning, because they do not employ surveyors or engineers for this work. On the other hand, there is some criticism of the surveyors and engineers for not keeping abreast of the times in planning methods. The same engineer previously quoted states: "Methods in the subdivision of land have progressed far beyond the old methods. If the surveyor or engineer does not keep pace with the times, this work will be handled by those who do. This is more evident every day and is a greater threat than most realize."

One of our land surveyors who has a considerable practice in subdivision planning defines a land planner as one who should be competent in the fields of drainage, sanitation, traffic, social habits, and engineering economics. It is his opinion that a majority of the land surveyors in California have been practicing land planning in connection with property development since the beginning of same and that this planning by both civil engineers and land surveyors has been both good and bad. He further suggests that both civil engineers and land surveyors are in need of a land planning education. It is his opinion that the land surveyor need not necessarily be required to qualify as a land planner to practice land surveying, but that he must, if he chooses to practice in a phase of land surveying where planning is necessary, be adequately qualified in land planning to perform a professional service which directly benefits himself, the public, and his client.

A sampling of surveyors in city, county, and State agencies in California showed that practically all those questioned were registered engineers or licensed land surveyors and that about one-third of them were in some way connected with land planning. Their opinions did not differ materially from those of the private engineers and land surveyors. A very small sampling in neighboring States indicates conditions and opinions similar to those in California.

From this very incomplete study of the role of the surveyor in land planning, I have come to the following conclusions: The surveyor should take such an active part in civic affairs that he is assured of participation in, or a fair representation on, the planning commissions. He should exert all ethical and legal influence possible to see that those commissions exercise their authority to employ surveyors and engineers to aid those concerned with the nonengineering aspects, in a coordinated effort to produce good planning. Surveyors or engineers employed either on a full-time basis or as consultants must have an understanding of all the aspects of planning, so they must supplement their education with formal and informal study of the complete problem of land planning. The surveyor who plans subdivisions should also supplement his technical education with formal and informal study of the over-all work of planning. If he does this, he will not limit his thinking to the narrow confines of the immediate area of his subdivision and its engineering problems, but will include all the elements of a good plan for the development of any larger areas involved. He will be better prepared to eliminate future disagreements with planning commissions, or at least be better able to compromise such disagreements. This is what I meant, when I remarked at our meeting a year ago, that we should join them if we can't lick them.

DISCUSSION

JAMES L. BELL (Kansas; 1960 Chairman, Property Surveys Division): I would like to ask Mr. Matheny if his committee knows of a place in the United States where the land surveyor is

prevented from doing land planning, either by legislation or by the attitude of a local board.

MR. MATHENY: I have no knowledge of a specific area in which the surveyor is specifically prohibited from doing land planning; however, there are numerous areas—and our own region happens to be one—in which there is a definite trend toward discouraging the surveyor's efforts in land planning. The planning board has employed career planners to prepare the preliminary layouts for the surveyor to work from.

PROF. ARTHUR J. MCNAIR (Cornell University, New York): My question relates to the amount of education which is currently being given to civil engineering students, or, for that matter, to any college students. Currently, the requirements in civil engineering in the United States, on the average, are for approximately 6 or 7 credit hours out of an average of 140 credit hours required for a degree. This amounts to two, or possibly three, semester courses in surveying. Does this leave the land surveyor in a position to claim a profession, a professional training, or a professional education, as compared with the land planner, who may take many more hours of work directly connected with his field and who may, after graduation, take a year of graduate work, and thereby claims that he is a professional?

I think that perhaps the difficulty lies with all of the civil engineers and land surveyors in that they do not put up a concerted request to the educational institutions of this country, asking that more work be given in surveying. If a man gets three hours of elementary surveying and three hours of route surveying or highway location, whatever it may be called, this hardly seems to qualify as giving him proper professional background for land surveying.

MR. AGGELER: You have hit upon a problem which is beyond the province of this committee, but certainly one which is very pertinent. This seems to me to be a subject which is to be thoroughly discussed at the Education Division Plenary Session this afternoon. I would suggest that these questions be hashed out there, inasmuch as we are not concerned with the problem at the present moment.

CHAIRMAN BILL: The Property Surveys Division might be exercised over the need for greater educational facilities. We intend to have an Education Committee working during the coming year.

PROF. PAUL P. RICE (New Jersey): I represent the Land Surveyors Functional Section of the New Jersey Society of Professional Engineers. I would like to supplement the remarks of the panel speakers this morning with the following information, because we have had a very serious problem in this matter of planning in New Jersey.

In New Jersey we have a planning bureau in the Department of Conservation and Development that has been headed, until a few years ago, by what has been termed here this morning "a career planner." This individual, together with some other planners, and with the help of the American Institute of Planning, introduced in the legislature last year a most obnoxious bill to license planners. On May 9, 1959, our State Board of Trustees sent to all the senators a night telegram opposing this bill for the following reasons:

1. No need exists for a law to license planners.

2. There is no accord among planners as to the scope of their activity.

3. There is no accord pertaining to qualifications or educational requirements.

4. No definite time is required for post-graduate experience.

5. Planning, specifically and generally, is basic engineering and architectural work and necessitates technical training.

6. The work involved in [the bill] does not call for precise action and legal responsibility as required in other professions.

7. Licensure as a planner would permit professional practice in engineering, architecture, law, accounting, etc.

8. Public health, safety, and welfare are adequately protected by existing laws covering the practice of engineering, land surveying, and architecture in New Jersey.

9. No similar bill has been passed in any State. We strongly question the constitutionality of [the bill].

Now that, briefly, gives you some idea of how wide is the scope of this bill.

A group of our men from the New England Society of Professional Engineers have attempted, during the past summer, to iron out these difficulties, without success. However, the planners misrepresented themselves and again introduced this bill in the Assembly exactly as it was a year ago. They pulled a fast one on us, so to speak, and it passed the Assembly 37 to 11 a few weeks ago; however, we have been on the job and the bill, as far as the State Senate is concerned, is in committee. We hope it is going to stay there. Fortunately, the majority leader of the Senate is an engineer, and it is not likely to get out without his approval.

We hope the planners cannot pass this bill, but they may try it in some other State. New Jersey is, so to speak, a guinea pig. The American Institute of Planners hopes to get this bill through. If they do, then they will try everywhere else. That is what you may be up against in the many States represented in this group.

Based on our unusual experience in New Jersey, therefore, I urge you to be on the alert. This bill may come up elsewhere, and it is believed to have backing by, and the sponsorship of, the American Institute of Planners. This is not altogether a battle to be carried by New Jersey people.

I also urge you to recognize the fact that there is a legitimate field for planning that ought to, within its limitations, be licensed and legally recognized.

We were hoping last year to modify the present laws of New Jersey regulating the practice of land surveying and engineering to include planners. But the planners are so far off on a deep end that, at least last year, there was no reasoning with these people.

Now the last thing I would like to call to your attention is that we, as surveyors, need to become better informed on planning in some way or other—by extension courses or by reading or attending meetings. There is a place for planning.

And finally I would like to make this comment: If we as surveyors had not been asleep in the past twenty years and had, instead, recognized that there was a field for planning, engineers and surveyors would be doing the planning and we wouldn't have this problem on our hands.

W. B. Williams (Michigan; 1958 President of ACSM): Is it not true that we are confusing the question of land planning with the question of subdivision design? Land planning is more in the broad social field—figuring out how much area you are going to need for schools, for parks, and various other things. Subdivision design is the actual design of a particular piece of property for sites of one type or another. Has that been considered at all by the panel?

Mr. Aggeler: I think I pointed out that some of the engineers I contacted found that there was confusion of definition. They said that the site planning was the engineering feature, while the over-all planning and area planning was the job of the planner; so this definitely is being thought of by the engineers.

Mr. Williams: I would only strain at the term "site planning," because that is generally used by the architects, whereas our term, "subdivision design," would be better.

John J. McMahon (Michigan): My question is to the second speaker, who suggested that possibly we should license planners. I am wondering if you have given any thought to the educational requirements of land planners.

Mr. Reese: No, I haven't any specific ideas as to what their educational background should be, but it has been suggested by many that they should be licensed to be able to practice land planning. The planners have the idea in mind that licensing would permit them to include surveying within their functions.

E. F. Thatcher (Missouri): We do a lot of urban work. I wonder if many of you have come up against the city manager who is taking the place of land planners. I address that question to the whole panel.

Mr. Shaw: In our case in New York City, the mayor is taking that upon himself and, as I said before, he has appointed a firm of architects to replan and rezone the entire city of New York. I also said that, if there were some engineering surveyors on that committee, much of the criticism would be eliminated.

T. C. Horstmann (Missouri): In our part of the State we have the same difficulty in distinguishing between land planners and land surveyors. A good many land surveyors feel that they are qualified to do land planning—that is, including subdivision planning. The question has been raised several times; however, we have never been able to come to an agreement as to where the lines should be drawn. We have no planners' licensing in view, however. The land surveyor has been doing a good share of the planning, and in some cases the realtors and real estate promoters.

Voice: In Vancouver, British Columbia, the city planner is or was a civil engineer. When one becomes a planner of that status—the head of a planning department—he should forget that he is firstly a civil engineer. However, the deputy planner was at one time the assistant city engineer and a land surveyor. The head of the regional planning board, for the region that reaches up the Frazer River a hundred miles, is also a civil engineer. But the crux of the matter is that these are civil engineers who, through their practice and their education, have become qualified planners. This is one thing that we must not forget in proposing that the surveyors become planners. They must become qualified. Planning must be a part of their education and a part of their experience and training before

they can insist that they be the planners. If and when they do have that education and training, there are no others who are better qualified than surveyors.

F. I. G. Meeting, Brussels

The Comite Permanent (Board of Direction) of the Federation Internationale des Geometres met at Brussels, Belgium, June 24–28, 1960. The American Congress on Surveying and Mapping was represented by Willard Walker, Fresno, California, and Captain Michael M. Mitchell, U. S. Air Force, presently stationed in Germany. Walter Hanna, Gilroy, California, was enroute to Brussels, but was taken ill in Austria and was unable to attend the meeting.

The most important action taken at this meeting was the postponement of the Tenth International Congress of Surveyors, originally scheduled to be held in Vienna, Austria, in 1961, to late August and early September 1962, to permit additional time for preparation.

The Eleventh International Congress of Surveyors is scheduled to be held in Rome, Italy, in 1965, and the Twelfth Congress is to be held in London, England, in 1968, a date coinciding with the centennial of the Royal Institution of Chartered Surveyors, the member Association in England.

Because of the postponement of the Tenth Congress, the Comite Permanent will meet again independently, probably during June 1961 in Berne, Switzerland. The American Institute of Real Estate Appraisers, the other American association in the F. I. G., has invited the Comite Permanent to hold its 1963 meeting in the United States. This will be its first meeting to be held on this side of the Atlantic.

Cartography Awards

The Cartography Division is pleased to announce that two awards of $75.00 each, will be offered this year for the most outstanding papers on some timely phase of cartography, as an aid in promoting the development of cartographic exposition in SURVEYING AND MAPPING, the Quarterly Journal of ACSM. Entries must be submitted for publication during the period beginning August 1, 1960 and ending at the start of the 21st Annual Meeting of ACSM in March 1961, at which time the awards will be presented. Members of the Executive Board of the Cartography Division will serve as judges to determine the winning articles.

By Way of Explanation

If, when you get it, you are disappointed with the size and/or quality of the September 1960 issue of SURVEYING AND MAPPING, listen to our tale of woe before you take your pen in hand to call us down for our delinquencies.

Your editor had the June issue all finished up except checking changes on the page proof when he left for Manhattan College Camp to teach. The corrected page proof was received a day or so after he arrived there and was sent back the next day. He had only been in camp about eight days when he played out physically and, after only ten days in camp, had to pack up and come home. He arrived on a Wednesday morning, saw his doctor and the surgeon that same day, entered the hospital the following Sunday, was operated on the following Thursday, and left the hospital ten days later. However, the mere fact that he was home from the hospital did not make him feel much like working. It was not until about July 10th that he was able to get going on his editorial work. The approximately four weeks away from the editorial work, really caused quite a severe setback in a schedule as tight as is necessary, even for a quarterly publication.

However, by dint of long hours on the part of the editor, a lot of good help from others here in Washington, and complete cooperation on the part of the Business Press, Inc., in Lancaster, Pa., we seem to stand a reasonably good chance of coming out about on time, even though this issue may be a bit thin.

Please do not be too hard on us, and we will try to do better next time.

—EDITOR

Mapping the Low Water Line of the Mississippi Delta

By BENNETT G. JONES and WILLIAM SHOFNOS

UNITED STATES COAST AND GEODETIC SURVEY

THE Submerged Lands Act of 1953 (Public Law 31) which confirms and establishes titles of the States to lands beneath navigable waters within their "historic boundaries" has again brought into focus the importance of adequate tidal boundary determinations. The Act stipulates that the baseline for the measurement of seaward boundaries of the States where no indentations exist is the "line of ordinary low water". The term "ordinary low water" lacks the technical precision that is required in the establishment of tidal boundaries. However, "ordinary low water" where used is usually considered to be synonymous with mean low water.

The establishing of boundaries determined by the course of the tides involves two engineering aspects: a vertical one predicated on the height reached by the tide during its vertical rise and fall and constituting a tidal plane; and a horizontal one relating to the line where the tidal plane intersects the shore to form the boundary desired. The first is derived from tidal observations alone and once derived (on the basis of long period observations) is for all practical purposes a permanent one. The second is dependent on the first and can be determined therefrom by leveling from tidal bench marks, or by photographing the shore at the proper instant of the tidal cycle, i.e., at mean low water, or mean high water, etc. The boundary line thus determined and mapped on the National Horizontal Datum is permanently recorded in horizontal position as the boundary on the specific date of the survey. However, this boundary, the actual line on the ground, is subject to change by erosion, accretion, and the works of man.

This paper describes the application of modern methods of infrared photography and photogrammetry to mapping of the mean low water line of the Mississippi Delta country where ground survey methods are prohibitively difficult and expensive because of the swampy character of the terrain. Of particular interest are the tidal characteristics of this area and the facility with which the low water contour is captured by the infrared photography even in extremely shallow and muddy waters.

This is a cooperative project between the Coast and Geodetic Survey, the Federal Bureau of Land Management; and the State Mineral Board of the State of Louisiana. The purpose of the project is to provide additional basic tidal data and up-to-date planimetric maps for revision of Coast and Geodetic Survey nautical charts; and to provide the Bureau of Land Management and the State of Louisiana with a special set of these maps showing the mean low water line and the coordinates of turning points selected along that line by the State of Louisiana and the Bureau of Land Management. The maps from this project will be used to administer the development of the extensive offshore oil and gas fields in this area. Figure 1 shows the map layout of the project comprising 14 7½-minute quadrangles and a land area of about 450 square miles.

Low water line mapping of most of the coast of Louisiana was completed about two years ago but the Mississippi Delta and the coast line around Atchafalaya Bay and Marsh Island, because of the more extensive foreshore areas and shoals, had to wait until arrangements could be made for detailed tidal surveys and the establishment of accurate tidal datums.

Presented at the 20th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 21–23, 1960.

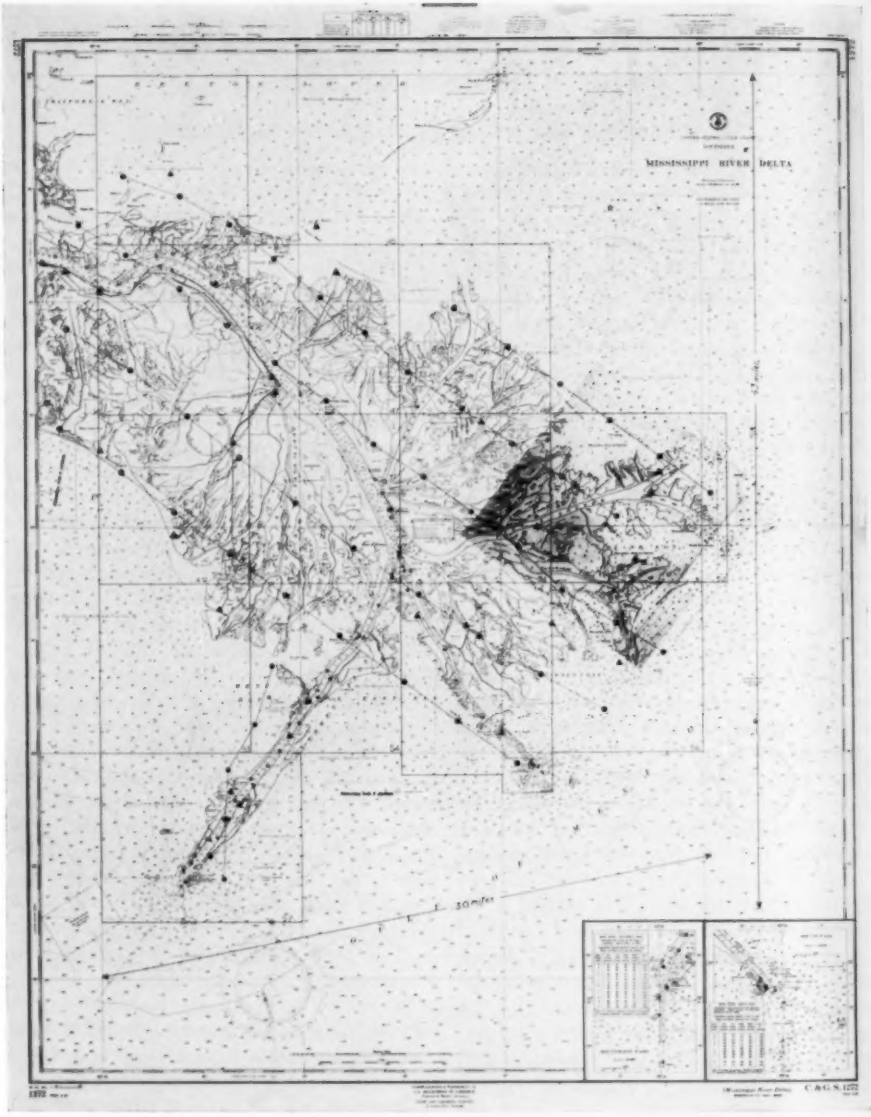


FIGURE 1.—Project diagram showing map layout, nine-lens photographs, and controls stations.

The changing nature of the Mississippi Delta and the consequent need for periodic remapping, or map revision, for the up-to-date maintenance of nautical charts is illustrated in Figures 2 and 3. Figure 2 shows the limits of the Delta from an 1894 chart (shaded area) (surveys between 1859 and 1872) in contrast with the present limits (Chart 1272). Extensive changes are apparent to the east and south. No comparison is indicated on the western shore as that area had not been surveyed and is not shown

FIGURE 2.—Comparison of 1894 and current nautical charts.

on the 1894 chart. The Coast and Geodetic Survey mapped this area with aerial photographs for the first time in 1922. Figure 3 shows the changes in the Garden Bay area between photogrammetric surveys of 1922, 1932, and the present.

MAPPING PLAN

The Delta, as one would expect, is low lying and predominantly marsh with many bayous and shallow bays, some of the latter being very large. Except for fringes of

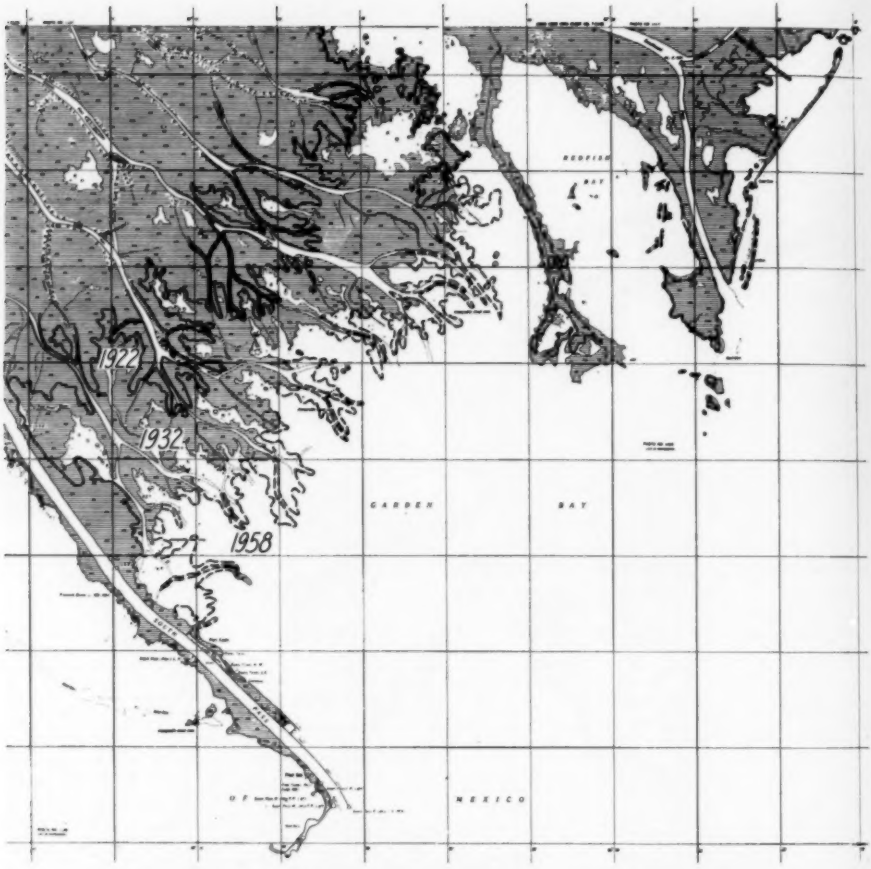


FIGURE 3.—Comparison of shoreline from 1922, 1932, and 1958 surveys.

trees along the river and main passes, the vegetation is predominantly marsh and wild cane. The latter is found in places throughout the Delta but predominates along much of the coast. It is extremely dense and grows to a height of perhaps ten feet, Figure 4. The coast area floods at high tide and as seen from seaward the apparent mean high water line is against the marsh and wild cane. The mean low water line is mostly along the mud banks and flats but is rarely seen because only a very few of the low waters occur during daylight—a circumstance peculiar to this area and extremely important as regards aerial photography at low water stages. Travel in this area must be by float plane, helicopter, marsh buggy, or boat. Boats are of little use outside of the main channels because of the extremely shallow waters. Ground survey activities such as leveling, traverse, and so on are extremely difficult in any case and next to impossible around much of the coast line. Consequently, the plan for the project called for maximum use of aerial photography and photogrammetry including color and infrared photography, and a minimum of ground work. The project included these primary phases or activities:

(1) Nine-lens photography for basic

FIGURE 4. —Typical growth of wild cane.

planimetric mapping was taken in October, 1958. Figure 1 shows the layout of photographs and the horizontal control stations identified to control the plot with those photographs. The photogrammetric plot and the subsequent mapping was at scale 1:20,000, and the illustration shows the area covered by a single nine-lens photograph. This photography was a very real advantage because of the relative scarcity of existing control and the difficulty of identifying control on the aerial photographs.

(2) Tidal surveys, to establish basic tidal datums, started in April, 1959, and are to be completed in April, 1960.

(3) Low water infrared aerial photography controlled from the tide stations after establishment of the mean low water datum was taken in December, 1959. Infrared photography was selected for mapping the low water line because it provides a sharp contrast between land and water and thus captures the tide stage contour accurately.

(4) Field examination of the infrared photography was made at mean low water by float plane or helicopter in December 1959 and early January 1960.

(5) Completion of the basic maps and

FIGURE 5.—Portable tide gage installation.

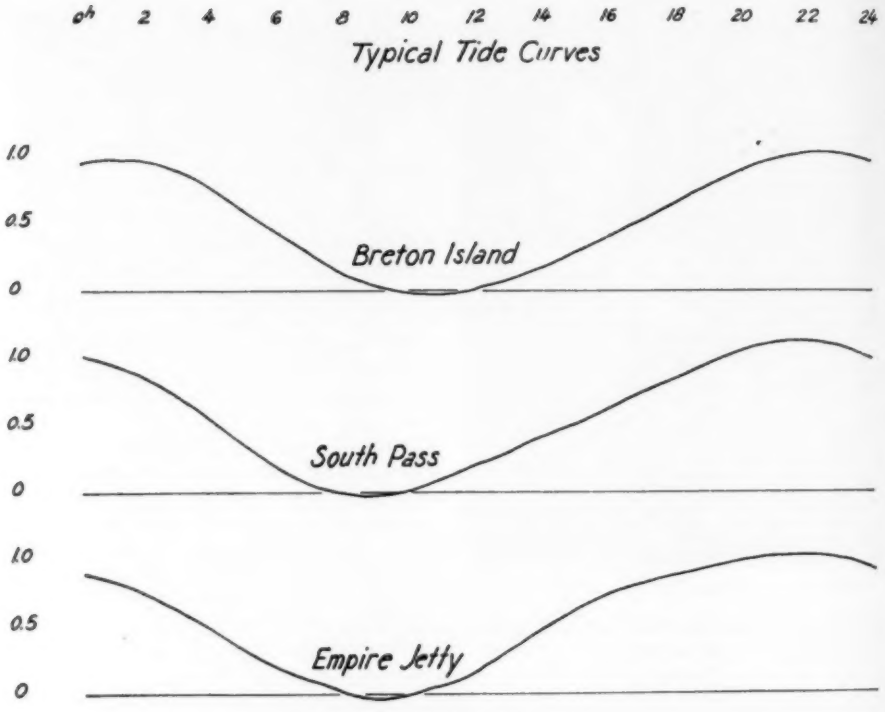


FIGURE 6.—Typical tide curves.

compilation of the low water line from the infrared photographs is now in progress and will be completed this summer.

Prior to this project very little tidal data were available for the Mississippi River Delta area. Tidal datum planes (mean low water, half tidal level, mean high water, etc.) had to be determined. While the plane of half tide level could be assumed to be at approximately the same elevation along considerable stretches of the outer shore of the Delta area, the range in tide and consequently the elevation of mean low water below half tide level could vary appreciably from place to place due to differences in hydrographic features. Consequently, observations had to be made at a sufficient number of places to determine the mean low water datum for all places around the entire outer shore of the Delta.

After a careful and extensive reconnaissance of the area, eight tide stations were established. Their locations are shown in Figure 8. Two of these are standard tide gages set on semipermanent structures of the Kerr-McGee Oil Co. at Breton Island and the U. S. Coast Guard at South Pass. The remaining six are portable gages. These require servicing every three or four days. They had to be placed far enough off shore so that there would always be at least five feet of water at low tide. Consequently, many of the portable gages and most of the tidal bench marks (three to a station) are on wooden piles driven at least 20 feet into the Gulf bottom. A typical portable tide gage installation is shown in Figure 5.

Observations at all stations were started no later than April 1959 and will continue through April 1960.

A period of 19 years of tide observations is generally considered as constituting a

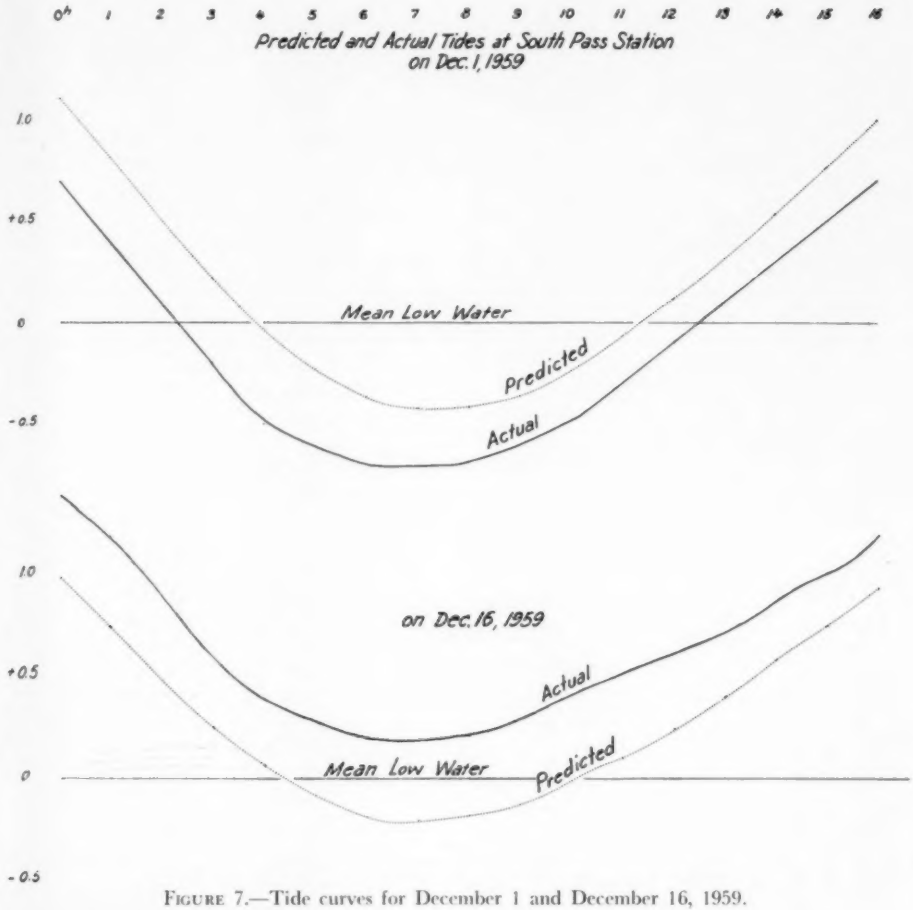


FIGURE 7.—Tide curves for December 1 and December 16, 1959.

full tidal cycle, for during this period of time the more important of the tidal variations will have gone through complete cycles. Tidal datum planes thus determined may be taken to constitute a primary determination. However, long experience and analyses have disclosed that good determinations of mean values can also be obtained by a direct comparison with simultaneous observations at some nearby place with similar characteristics and for which a 19 year series of observations is available. It became quite apparent when the tide observations at the various stations were examined that without exception, the characteristics of the tide at the eight tide stations are quite similar to those at Pensacola, Florida. Since a 19 year series of tide observations is available for Pensacola (1940–58) mean low water and other tidal datums around the Delta will be determined from twelve months of observations compared with simultaneous observations at Pensacola.

Certain characteristics of the tide in this area are of critical significance as regards the taking of aerial photographs at mean low water. The tide in this area is principally diurnal, that is, there is but one high water and one low water a day except when

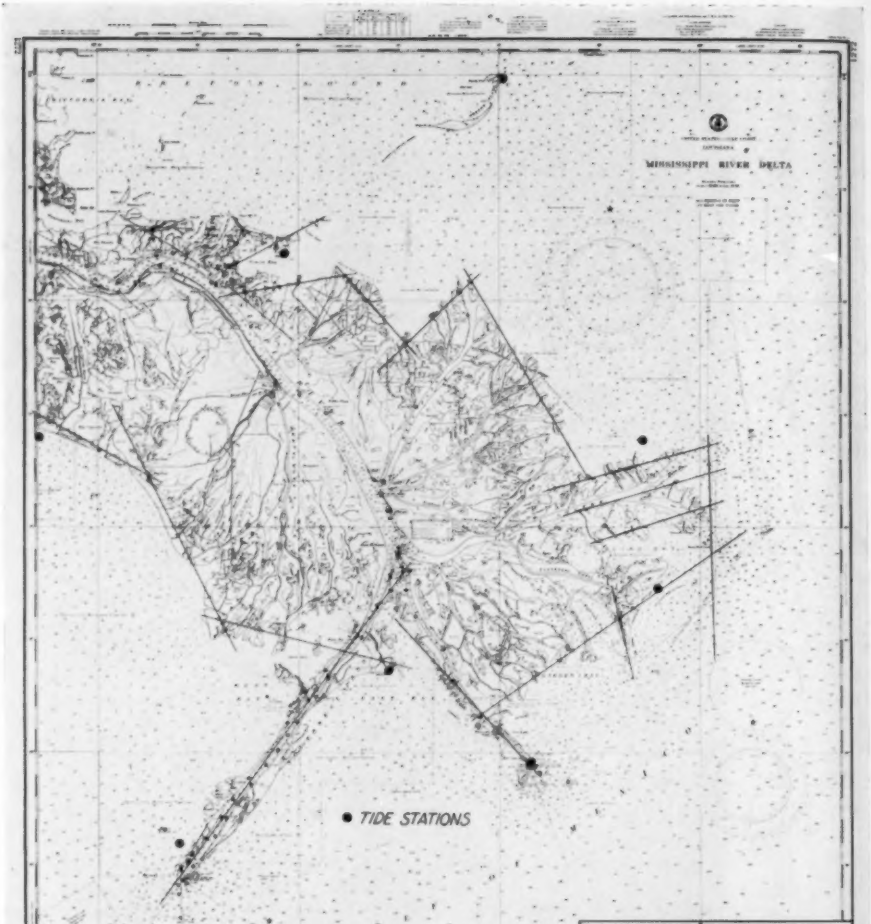


FIGURE 8.—Tide stations and infrared flight lines.

the moon is on the equator. Figure 6 shows typical tide curves at the western, southern, and eastern limits of the project. The mean range (the difference in height between mean high water and mean low water) is about 1¼ feet. The variation in rise and fall is related primarily to the declination of the moon and the sun. Maximum and minimum tides occur about the time of tropics, when the moon is at maximum declination. Of more importance is the fact that most of the low tides reaching mean

low water or below occur at night. This is due to a combination of factors which will not be discussed here. Daylight (photographic daylight) low waters occur almost exclusively during the period from late November to late January. Consequently our low water aerial photography had to be taken during this period of 1959–60, after about six months of tide observations or a year later in 1960–61.

The delay of one year was undesirable both from the standpoint of map needs and costs. Consequently it was decided to determine preliminary planes of low water at the tide stations based on about six months of tide observations, compared with the 1940–1958 series at Pensacola. This was done and it was on the basis of these tidal planes that the photogrammetric work was begun. It is very unlikely that the mean low water plane will change more than 0.1 foot when the complete year of observations is obtained. If there is a change, it now appears that the datums will be slightly higher than determined from the six-month series.

Several days of daylight low water and clear skies were needed for the aerial photography. From the foregoing it is evident that this is a rare combination on the Delta. It was not realized how rare until after arrival in the area. Tide predictions indicated some 25 low waters during photographic daylight (9:00 a.m. to 3:00 p.m.) between 28 November and 30 January. Long-term weather statistics indicated cloud cover of over 10 percent for about 80 percent of the time. Thus only five days for mean low water photography could be expected between 28 November and 30 January. Plans for the infrared photography had to be based on this estimate but there was still a wild card in the deck—the wind.

As previously stated, the mean range of the tide is about 1¼ feet. Because of the extensive shallow waters surrounding the Delta, a continuing northerly wind can cause the tides to run as much as ½ foot lower than predicted and a continuing southerly wind can make them ½ foot higher than predicted, i.e., eliminate the predicted mean low water. Figure 7 illustrates this. This shows the predicted and actual tides for December 1 during a norther, and the predicted and actual tides for 16 December with fairly strong winds from the south. There was no way to predict what the winds would do to the plan of operations—one could only hope, pray, and worry.

Now let us see what actually occurred. Due to the norther that started just when the aerial photography was undertaken there were four days of combined low waters and photographic weather between 29 November and 7 December. Tide and weather records show that only one such day occurred for the entire period after that, that is, from 8 December to 30 January. The infrared photography was finished by 7 December, and it is well that it was because waiting in the area for another seven weeks would have provided only one good photographic day.

The aircraft was based at New Orleans—a distance of some 80 miles. The primary tide station for controlling the photography was at South Pass where telephone communications with the flight crew were available. Figure 8 shows the tide stations and the infrared flight lines to be covered at an altitude of 10,000 feet, that is, at scale 1:20,000. A tide observer was also quartered at Breton Island, this being the only other station where quarters were available for an observer. The remaining six stations in the project could be occupied only from a fairly large boat that could stand the weather and also provide protection for the observer. The Coast and Geodetic Survey launch was used to occupy first the Empire Jetty and later the Joseph Bayou Station. A launch, not equipped with radio, and observer loaned by the Texas Company through the good offices of Mr. Martin Standard, also occupied the Lonesome Bayou Station for several days to read the staff in case of a gage failure.

Communication between the tide observers and the aircraft was by handy-talky radio and after installation of a proper aerial in the aircraft this communication worked very well.

At about 5:00 a.m. each morning, the ob-

server at South Pass would plot a tide curve for the preceding eight or ten hours and then project this curve to determine the approximate time of mean low tide for that day. He would then call the flight crew telling them whether to come to the area and, if photography was to be attempted that day, when to arrive on the project. The latter was necessary because when strong winds were blowing the time of the tide might vary an hour or more from the predicted time. Once in the area the plane was directed by radio, that is, it was told what line to fly at what time.

A preliminary flight inspection around the entire outer coast was made at low tide early on 29 November. This inspection was considered essential since there were a number of unknowns critical to the project. For example, it was essential to know whether the low water line was generally just inside or outside of the edge of the marsh and wild cane; where the shores were steep and represented an easy mapping job; and where the more extensive mud flats existed since these would be the more difficult to map. This inspection proved to be invaluable. The western shore was found to be generally steep and the more extensive flats on the eastern shore that had to be given particular attention were spotted. Needless to say, the field crew was delighted to find that the mean low water line in most instances, was outside the edge of the grass and wild cane.

Taking all of this photography exactly at mean low water would have required more flying days than could be expected even with extreme good luck. This is because of the obvious fact that the tides do not go exactly to mean low water and stand there, or at least only rarely. The tide will usually either not go as low as mean low water or it will go below mean low water. Figure 7 illustrates the conditions under which the infrared photography had to be taken. Because of the early morning occurrence of mean low water, it was necessary to work on minus tides and to photograph the coast line as nearly as possible at the time the rising tide crossed mean low water datum; the rate of rise being about 0.2 feet per hour. The time difference between the occurrence of mean low water at different stations helped somewhat, that is, the tides could be followed, but these differences are small for most of the project.

The field crew had to assume that one good day might be the only and last day. Consequently, photography was started with the tide as much as 0.4 or 0.5 feet below mean low water on the less important lines, that is, on the west side where the shore was steep; then moved over onto the most important lines just before or at the time of mean low water; photography was then continued on other lines until the tide was up to 0.1 or 0.2 feet above mean low water. This latter photography might never be used but then again it might be better than nothing.

On subsequent days, the same procedures, more or less, were followed, cleaning up the more important lines close to the mean low water datum and repeating those that had been flown slightly off. On the flat shores lines were deliberately repeated at slightly different stages of the tide so as to have a means of interpolation in cases where the photography could not be taken at exactly mean low water.

As mentioned previously the norther that blew into this area about 28 November continued more or less unabated for about a week. It held the water off the shore, making the tides go lower than predicted and causing mean low water to occur later in the day. It was accompanied by generally clear skies providing four days of photography in the first nine days on the job.

In summary, the outer coast line, with the exception of a small section of the west shore, is covered with infrared photography taken between zero and -0.3 feet of tide. All lines on the project have been photographed from two to four times with coverage ranging between $+0.2$ and -0.4 feet for interpolation of the mean low water line. Figure 9 is a fair sample of the infrared photography.

FIELD EXAMINATION

The next step after completion of the photography was to inspect the photographs,

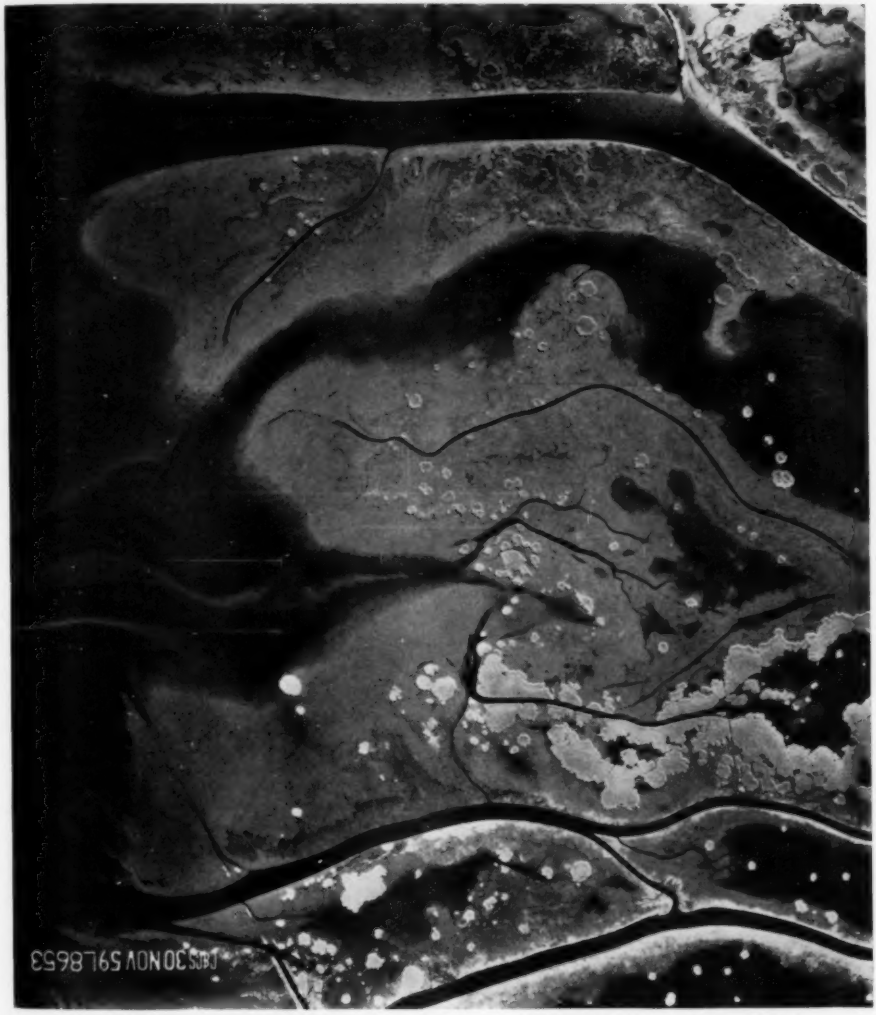


FIGURE 9.—Typical infrared photograph.

that is, compare them with the shoreline at, or very nearly at, the mean low water tide stage. This was done by float plane and helicopter, mostly by helicopter.

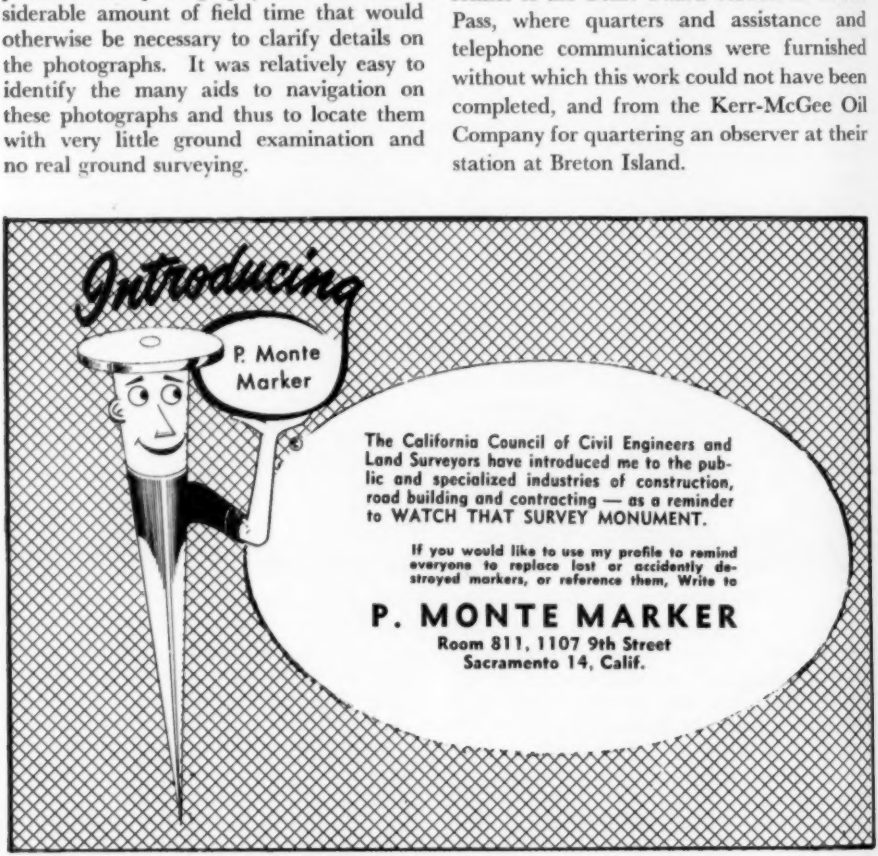
Such an inspection was necessary, first, to be certain to find small off-lying mean low water islands or spots that might not be detected from an office examination of the photographs. Examples of this are the numerous mud lumps off Pass A Loutre and Southeast Pass and the tops of shell reefs in Grand Bay. Secondly, it was necessary to search out the mean low water line in the few instances where it occurs just inside the edge of the wild cane; and third, to check the interpolation of the mean low-water line when the photographs had not been taken at exactly mean low water.

The practice was to fly to and read a staff at the controlling tide station and then to inspect that section of the shoreline reading the staff again upon completion of the inspection.

As regards the accuracy of the mean low water line, all the evidence indicates that it is located within about 0.1 feet vertically, and that this is about all one should expect in this area with any reasonable expenditure of time and money.

Color photography was used for the location of aids to navigation and for interpretation of natural and cultural features on the planimetric maps. Color photographs provide a wealth of detail not visible on panchromatic photography and save a considerable amount of field time that would otherwise be necessary to clarify details on the photographs. It was relatively easy to identify the many aids to navigation on these photographs and thus to locate them with very little ground examination and no real ground surveying.

In conclusion, the authors wish to acknowledge the very generous and considerable assistance received in the area: From Dr. Gordon Atwater of New Orleans for his interest and enthusiasm and his assistance in providing us with an initial flight inspection of the entire project area. From the Texas Oil Company, particularly from Mr. Martin Standard, who has had many years experience on the Delta, for his assistance in briefing us on the nature of the country, the weather, and the tidal conditions, and for providing a boat and observer for tide observations at Lonesome Bayou. From the Coast Guard at New Orleans and the personnel of the Coast Guard Station at South Pass, where quarters and assistance and telephone communications were furnished without which this work could not have been completed, and from the Kerr-McGee Oil Company for quartering an observer at their station at Breton Island.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Can the Mariner Trust His Chart?

By ROBERT J. BEATON

U. S. NAVY HYDROGRAPHIC OFFICE

I HAVE been asked to discuss the broad subject of nautical chart evaluation, with particular attention to some specific merits and limitations of existing and potential systems. To tackle this assignment one must first be clear about the general approach. It makes all the difference, for example, whether we are thinking of the evaluations made of sources that concern a chart being compiled, or whether we suppose the evaluation is made of the published chart whose sources are unavailable and, perhaps, partly unknown.

Objective

The first suggestion I wish to make is that our present objective should be to identify the various factors that affect both types of evaluations and to develop workable criteria and meaningful terms that make it possible to classify a chart's characteristics. If this task can be done with success, there is a chance of being able to answer specific queries by other nations who possess similar requirements for establishing understandable terms and standardized methods to assess the accuracy of charts.

The Mariner's Method of Evaluating Charts

How the mariner, who has over 240,000 nautical miles of seacoast and more than 105,000,000 square nautical miles of ocean areas in which to navigate, evaluates each chart for his particular route is largely a matter of personal knowledge, experience, and judgment. Some of the practical considerations that he may apply in determining a chart's worth include the identity and reputation of the publisher; chart scale and sheet limits relative to intended use; overlap on adjacent coverage including consistency of geographic graticule; lack of caution notes; currency of information and the amount of detail accurately and legibly presented with respect to the character of the sea bottom, safe channels, main terrain details, and other navigational features that ensure safe passage. The mariner weighs these factors, usually in the light of his own personal knowledge of the area, and makes prudent allowance for possible unreported or incompletely charted dangers.

To some extent, the mariner's task of evaluating charts is not difficult, because most of the information needed to form an opinion has become reasonably standardized on charts during the last 39 years, through the efforts of the International Hydrographic Bureau established in 1921. Therefore, from mariners long accustomed to judging charts by the criteria described, no particular demands have been made for additional evaluation data—although many have requested improved chart coverage.

The Cartographer's Reluctance to Print Evaluations

Moreover, chart makers have hesitated to print evaluation terms on charts for fear of unduly alarming the mariner and, consequently, interfering with his normal navigational use of the chart. This reluctance on the part of cartographers is perhaps justified in view of the lack of accepted chart appraisal standards, the tendency to use the chart for purposes that exceed its functional design, and the need to accomplish systematic field editing of the chart proof.

The difficulties associated with any nautical chart evaluation system are intensified by the fact that charts do not completely reflect the physical features of an area. As Lloyd Brown described the early sea charts in his book, *The Story of Maps*, "They treated in a simple, direct way the problem

Presented at the 20th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 21–23, 1960.

which concerned the navigator and ignored the rest." So it is that generalization is accomplished on modern charts: some details are suppressed by combination or omission, while other details are stressed. Nevertheless, their design as functional tools of the navigator makes them unique documents that show marine features and often coastal details more accurately than other publications.

Requirements for Chart Appraisals

Since World War II, however, a greatly increased number of users has developed for nautical charts as a source of geographical information. Much of this need is attributable to advances in instrumentation and weaponry, such as electronic systems and guided missiles. Today, in addition to the marine navigator, numerous cartographers, marine geologists, military intelligence analysts, and naval planning staffs consult charts and employ them in various ways. For example, charts are frequently used as base maps on which to apply specialized information for merchant shipping and naval operations. The need for assessing chart accuracy also has international aspects as I have already mentioned.

Unfortunately, many nonmarine users are not so familiar with charts of the area covered as the navigator, while others possess specific requirements that cannot be satisfied unless more information is known about the chart's background. One of the facts most sought after by researchers, for instance, is the exact positional relationship of the charted details to the geodetic datum accepted for the area. Of course, only through a complex procedure that embraces the influence of all operations from the field surveys to the printed chart, is it possible to gain some perception of the position error of points on the chart. Information of this nature, however, in conjunction with other data, is essential to the cartographer for planning the most economical method of compiling new charts and to the military planner for determining the positional accuracy of potential targets.

Significance of Supporting Data

The quality of the chart compiled by the cartographer is often reflected in the chart record by the exactness and completeness of his entries concerning pertinent historical facts, sources used, and compilation methods selected. On occasion, however, the cartographer may retain vital information in his memory instead of in the written record, and while he may know intimately the chart's qualities—no one else does. The problem of tracing a chart's history is further complicated, of course, when more than one cartographer is assigned to various compilation or revision phases. Nevertheless, accurate analysis of compilation errors, source material quality, and generalization encountered during these phases depends on the cartographer who has access to the original surveys and field revision data, plus other maps, charts, and photography of known reliability. Unless such sources are examined, an appraisal of a chart is likely to be largely a matter of conjecture despite its apparent accuracy and completeness.

Need for Standardized Evaluation Processes

To promote thorough appraisals, chart producers require a method of matching their product to an agreed standard of quality; in effect, a standardized system of evaluation for classifying nautical charts in the different categories of reliability. If such a method for appraising original sources incorporated on charts were adopted by chart production agencies, then the reproduced or recompiled charts would reflect the same evaluation, provided the proper cartographic standards were maintained. Eventually, the basic charts of each nation would exhibit an evaluation note which copying cartographers and other users could emulate.

Current Chart Evaluation System:

The current system of evaluating published nautical charts at the U. S. Navy Hydrographic Office contains elements of conjecture because so little original data in the form of surveys are available for foreign

areas. To classify hydrography (coastal and offshore), culture, and relief, we use the terms good, fair, and poor. Hydrography is evaluated according to chart scale, pattern of soundings, and currency. Depiction of cultural detail is classified from good to poor by comparison with maps of similar scale; and presentation of relief is similarly categorized depending on whether or not the method of portrayal is by spot heights, form lines, hachures, contours, or contours plus shading. The internal control accuracy of each chart is determined by a cartometric analysis. This system, supplemented by additional descriptive data and graphic indexes, finds its primary use in chart appraisal studies of regional coverage.

For individual chart appraisals based on examination of basic, original sources and other materials of known value the element of conjecture, however, can be minimized. Assuming the competency of the analyst, appraisal reliability can be achieved by employing available techniques that provide reasonably correct, if not exact, assessment of a chart's accuracy and completeness. The chief requisite is to adopt a standard method of appraisal and to employ meaningful terms of reliability.

Author's Purpose

The purpose of this paper, then, is twofold: (1) Advocate the portrayal of more complete and specific basic compilation data references and/or compilation diagrams as being highly desirable on nautical charts; and (2) Suggest a practical procedure for expressing qualitatively the reliability of nautical charts.

Development of Evaluation Processes

Figure 1 indicates how a beginning can be made by amplifying existing information shown on charts; namely, the addition of specific details concerning the type and timeliness of source materials.

Figure 2 illustrates a proposed compilation diagram which delineates sectors of the chart where specific sources were used. The supporting data shown adjacent to the diagram are similar to that given in Figure 1, except that by letters keyed to the diagram an index of sources is provided. This diagram and accompanying list of sources reveal the identity, scale, and date of each source, and indirectly furnish an index of reliability in accord with the practical considerations applied by the mariner. In the author's opinion, this kind of precise information on charts is long overdue and, certainly should not inhibit use of the chart from the mariner's viewpoint, but rather enhance his appreciation of its worth.

Figure 3 represents a proposed reliability diagram which, in addition to the data given in Figure 2, expresses the evaluation results in terms of adjective ratings and horizontal displacement (in feet) of detail relative to the chart datum and accepted datum. The Appendix describes the alphabetic-numeric code and criteria by which a chart is evaluated. Annex A to the Appendix defines the adjective rating system, with its correlation to the ratings of the alphabetic-numeric code.

Derivation of Evaluation Criteria

The proposed evaluation criteria are

COMPILATION DATA

H.O. Chart 236, 1: 50,000, 1st Edition 1953
Argentine Chart 1720, 1: 135,000, 4th Edition 1948
AMS Series L751, Sheet 1024 IV, 1: 50,000 Edition 1949
C & GS Smooth Sheet No. 011798, 1: 10,000, 1946
H.O. Smooth Sheets (Archive No. 71650). 1:20,000–1:50,000, 1953
U. S. Navy Aerial Photography, 1: 40,000, 1955.
Stereo-compilation, 1958

FIG. 1.

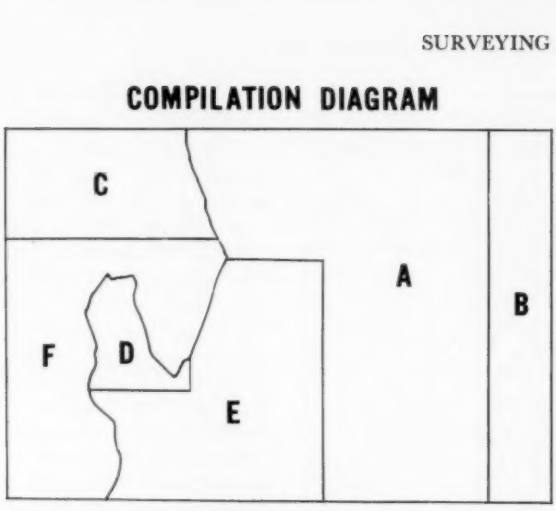

COMPILATION DIAGRAM
C
A
B
F
D
E
SOURCE DATA
A—H.O. Chart 236. 1: 50,000, 1st Edition, 1953
B—Argentine Chart 1720, 1: 135,000, 4th Edition 1948
C—AMS Series L751, Sheet 1024 IV, 1: 50,000, Edition 1949
D—C&GS Smooth Sheet No. 011798, 1: 10,000, 1946
E—H.O. Smooth Sheets (Archive No. 71650), 1: 20,000, 1953
F—U. S. Navy Aerial Photography, 1: 40,000, 1955. Stereo-compilation, 1958

FIG. 2.

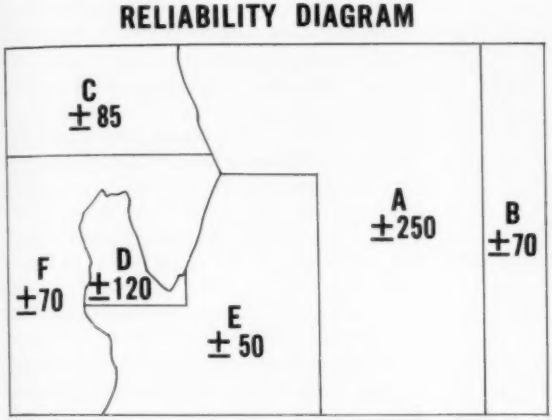
based on the Inter-American hydrographic survey accuracy standards and international topographic map evaluation criteria, both of which are modified here for application to nautical charts. The hydrographic survey standards were adopted by the American nations at the VII Cartographic Consultation of the Pan American Institute of Geography and History at Mexico City in 1955. These standards are currently being circulated by the International Hydrographic Bureau for comment by Member States. The topographic map evaluation criteria for military purposes have been established by mutual agreement in several countries during recent years.

Chart Evaluation Defined

Fundamentally, chart evaluation is an appraisal made for a specific reason before or after publication, and it concerns the accuracy and adequacy with which the features of a portion of the earth's surface, including underwater topography, are represented on charts. The principal data to be assessed are geodetic control, hydrography, coastal topography, tides, currents, and geomagnetic phenomena. Significant valuation factors relative to the chart and its method of preparation include the extent of geodetic control; survey instruments and methods; accuracy and currency of hydrographic detail, land planimetry and relief; completeness and legibility of data portrayed; and degree of standardization, producing authority, and comparison with other data.

How To Evaluate The Chart

The practical evaluation techniques employed by the mariner may also be used to advantage by the analyst as a preliminary step in evaluating published charts. Key information is ordinarily found in the title block, various notes, and marginal entries. These data include the control datum, identity and date of survey compilation and publishing sources, scale, units of measurement, tide and current characteristics, symbol references, and glossary of abbrevia-



RELIABILITY INFORMATION HORIZONTAL DATUM: ARGENTINE. Figures in diagram represent geodetic positional accuracy (In feet) of chart relative to ARGENTINE DATUM. The evaluated relationship of ARGENTINE DATUM to SOUTH AMERICAN DATUM is ±600 feet.

SOURCE DATA

A—H.O. Chart 236, 1: 50,000, 1st Edition 1953—Poor-Inadequate
B—Argentine Chart 1720, 1: 135,000, 4th Edition 1948—Good-Adequate
C—AMS Series L751, Sheet 1024 IV, 1: 50,000, Edition 1949—Good-Usable
D—C&GS Smooth Sheet No. 011798, 1: 10,000, 1946—Fair-Usable
E—H.O. Smooth Sheets (Archive No. 71650), 1: 20,000—Excellent-Adequate
F—U. S. Navy Aerial Photography, 1: 40,000, 1955. Stereo-compilation, 1958—Good-Adequate

FIG. 3.

tions. Other available sources of possible interest should be reviewed for mapping and charting developments, including the history of natural geographic factors and manmade facilities in the area.

The qualitative evaluation is made by examining and rating systematically the principal chart elements for adequacy according to scale and in terms of hydrographic, planimetric and relief accuracy, and completeness criteria. The appraisal system is described in the Appendix, supplemented by a discussion of the various elements in the following pages.

Scale—The evaluation criteria given in the Appendix are divided into two scale categories: (1) 1/600,000 and larger and (2) smaller than 1/600,000. The elements of evaluation take into account the scale as well as intended purpose of the chart and reason for the appraisal. For example, a large-scale (1/75,000 or larger) chart with some data displaced or inadequately detailed may possibly meet medium-scale (1/75,000–1/600,000) chart requirements.

Hydrographic Accuracy—Charts based on standard hydrographic surveys made in accordance with specifications acceptable to hydrographic authorities are reliable and accurate. The degree of accuracy to be achieved in navigation is on the order of 1 second or 30 meters; therefore, chart makers should strive for an accuracy at least twice as great as the mariner is able to plot. When remoteness of the area, or desired results do not justify carrying out a standard control survey of second- or third-order geodetic accuracy, a limited exploratory or running survey may be conducted with less rigorous methods and lower precision instruments. Therefore, some adjustment in adjective ratings should be made to account for the type of area being evaluated. Accuracy criteria for shore-controlled surveys and depth measurement are given in Tables 1 and 2 of the Appendix.

The control points for shore-controlled

hydrographic surveys are determined by astronomic observation and by triangulation or trilateration methods. If points obtained by either of the last two methods are tied into the accepted national or international network, they may be regarded for evaluation purposes as relatively error free. Local triangulation or trilateration nets that are based on astronomic stations inherit latitude and vertical deflection errors of the astronomic stations. Comparatively few hydrographic surveys are based on astronomic stations which have been corrected for plumb line deflections by means of gravimetric surveys. In coastal survey nets the usual method is to determine the relative deflection of the vertical at selected points (Laplace stations) by measurements of latitude, longitude, and azimuth.

The deflection of the vertical is of interest to the mariner only when establishing a position relative to a fixed point on land, such as a shore-based electronic aid. For normal purposes of celestial navigation the error is not significant, especially as the vessel nears land the deflection of the vertical tends to approach the value on land. Ordinarily, the mariner is chiefly interested in possessing a chart with adequate internal consistency, i.e., all features charted in accurate relationships to each other. This interest includes overlapping charts which should be on the same horizontal datum in order to minimize positional differences when navigating from the coastal waters of one country to those of another and when using radiolocation systems whose position lines span the coasts of several countries. Many charts covering oceanic islands possess these control deficiencies, for they are based on a conglomerate number of unconnected, local astronomic datums. Because the distances between these astronomic origins have not been measured, it has not been possible to determine the geodetic accuracy or the suitability of the ellipsoid for use in these particular areas. As more precise methods for measuring long distances over water develop, this deficiency will gradually be corrected for the benefit of mariners and geodesists.

The maximum error of plotted position when out of visual fixing range and using electronic methods such as Decca, Shoran, Lorac, or Raydist should not exceed 50 yards or 50 meters. Although the accuracy of the hyperbolic systems varies with position relative to the transmitters, it is sufficient for offshore surveys. For ocean surveys requiring the search and development of shoals, the maximum error when fixing a reference beacon by astronomical or electronic means should be 0.5 mile (1 km). When running sounding lines, the error of an astronomical position should seldom exceed 2.0 miles (4 km).

Evaluations of soundings are influenced by how carefully they are positioned on the chart. Because of unavoidable exaggeration of the symbolized sounding, the original depth in fathoms can easily be considerably misplaced when transferred to the compilation. For example, a 1-digit depth figure (0.16 cm high and 0.10 cm wide) covers an enormous area of 262 feet by 164 feet at 1: 50,000 scale. The center of the space occupied by the figures normally represents the position of the sounding, with the subscript figure merely attached. On some charts, however, soundings are shown in meters, and the portrayal may include the subscript figure as part of the sounding position.

Planimetric and relief accuracy—The first requirement for large-scale charting is that it be based on accurate, rigid geodetic control (plotted to 0.1 second or 2 to 3 meters). In some remote regions charts, through necessity, are based on reconnaissance data (as previously noted for hydrographic surveys) or uncontrolled aerial photography. Charts based on ground or photogrammetric surveys, executed in conformance with specifications of the national mapping agencies, are reliable and adequate. Accuracy criteria are discussed in Tables 3 and 4 of the Appendix.

The accuracy of the chart may be determined by comparison of relationship of chart detail to its geographic graticule with maps and charts of known reliability and other reliable data such as the accuracy standards of the producing agency. When a local datum is used to orient chart details,

the relationship of the local datum to an international datum should be noted when feasible. Where discrepancies are irreconcilable, a cartometric and/or photogrammetric analysis is necessary.

The cartometric analysis compares the geographic position of identifiable control points, i.e., triangulation stations measured on the chart with listed coordinate values. A preliminary investigation may result in sufficient data on which to estimate the chart's accuracy. The well-defined features on a chart compilation should be compared with the original sources for accuracy of transfer and generalization. Because nautical charts are often drawn from mosaics of foreign charts, the error associated with displaced detail points is likely to be larger than the error of the plotted control points.

The stereo-photogrammetric map accuracy test checks the alignment, position, and completeness of planimetric and inshore hydrographic features, as well as shape and detail of relief on selected stereo models. Contour elevations along arbitrary profile lines are compared with those of the test compilation and differences statistically analyzed. The results of those investigations, including field checks when practicable, are integrated into the total evaluation of the chart's accuracy.

Completeness—The criteria of completeness includes the state of revision and of standardization with respect to up-to-date status and legibility of information portrayed on the chart.

Planimetry on charts is usually limited to the coastal regions and, even in these areas, certain features like roads, buildings, and vegetation are omitted, unclassified, or unidentified because of their invisibility from seaward. Similarly, portrayal of topographic relief on charts is restricted to coastal landforms such as hills, ridges, cliffs, etc., which are of value for navigation by radar and other position-fixing methods. Further inland, navigational requirements for the portrayal of these features diminish rapidly. Generally, however, modern nautical charts portray waterfront facilities and manmade landmarks, along with shaded and contoured relief, in sufficient detail to compare favorably with land maps at similar scale.

Completeness also embraces the density and character of charted hydrography and other related detail, commensurate with scale and area covered.

Hydrography—The most important features of the chart are the soundings and depth curves which depict the main characteristics of the ocean floor configuration. The selection of soundings depends on the physical characteristics of the bottom, and no set specifications can be established. Least depths on shoals and practicable channel depths must be selected. Also, narrow passages and critical areas of uneven bottom should be depicted clearly and as uniformly as possibly, without the clutter of unnecessary soundings. The sounded depth pattern on the chart with well-delineated depth contours should be indicative of systematic surveys. On large-scale charts, the 1-, 6-, and 10-fathom curves are desirable; on medium-scale charts, the 6-, 30-, and 100-fathom curves.

For evidence of adequate hydrographic development, the survey sheets should be examined for adherence to the following standards. If the hydrographic survey sheets are not available, the chart itself may be appraised on the pattern of development presented, based on the same general guidelines and standards.

a. Spacing of principal lines at all scales shall be 0.4 inches (1.0 cm) or less (for example: 1667 feet at 1: 50,000), except where depth and character of the bottom will permit wider spacing, e.g., over drying banks and in large shallow areas that ocean-going vessels cannot transit. Spacing of cross-check lines should be 3 inches (7.5 cm) or less.

b. Spacing between soundings on line shall be less than that between lines, with peak and deep soundings shown.

Wrecks and obstructions—In order to be certain that an area is free of all hidden obstructions to navigation, which soundings alone do not reveal with certainty in uneven and rugged areas, the charts should show the clearance results of wire-drag

surveys if available. Wrecks and other obstructions that are considered dangerous to surface navigation (10 fathoms or less) must be charted. Also, for submarine navigational safety, wreck locations should be shown in depths to 300 fathoms on new chart editions of coastal charts.

Tides and Currents—The complete chart shows tide and current data if the phenomena exist and data are available. The configuration of the shoreline must be delineated, heights on land must be measured, and soundings made from the surface of the sea corrected with reference to some specified tidal datum or zero of elevation. Tidal data are especially essential in connection with the use of the chart because the navigator must know the available depth at all stages. Basic tidal data are listed in annual tide tables; consequently, the up-to-date status of the chart's tide note should be verified in the latest tide table.

Information relative to general ocean or tidal currents is depicted in various ways on charts such as current roses, diagrams, or notes that give directions and velocities of currents. The up-to-date status of the chart's current information should be verified, where possible, in the latest annual current table.

Geomagnetic Data—Above all things a navigator must know is direction, for without it he may never arrive at his destination. For the benefit of magnetic compass users, magnetic variation information is depicted on charts in the form of compass roses, notes, or isogonic lines. Iso-magnetic charts of the world are available for the 1960 epoch; therefore, the correct status of the chart's magnetic information should be verified with the appropriate sectional chart.

Bottom Samples—In general, a sufficient sampling is required to demarcate the limits where one general type of bottom changes to another. In waters that are liable to be used for anchoring, samples should be taken at frequent intervals (a bottom sample to every one or two square inches (10 to 15 sq. cm) of survey sheet). In other areas, shoaler or deeper, a spacing of 3 inches (8 cm) on the survey sheet is sufficient depending on the regularity of the bottom. Deepwater samples (over 100 fm (200m)) are classed as oceanographical observations requiring special equipment, and samples should be taken as required.

Scales—Large-scale charts are published at various scales depending on the importance and size of the harbor or channel and close-in coastal features. Harbor charts are generally larger than 1/50,000, and are intended for navigation and anchorage in harbors and smaller waterways.

Medium-scale charts are also published at various scales according to their intended use. Coast charts are usually from 1/50,000 to 1/100,000 scale, and are intended for close coastwise navigation when a vessel's course carries her inside out-lying reefs and shoals and for use in entering bays and harbors of considerable size. General charts are published at scales from 1/100,000 to 1/600,000, and are designed for coastwise navigation where a vessel's course is well offshore but where her position can be fixed by landmarks, lights, buoys, and characteristic soundings.

Small-scale charts are published at scales of 1/600,000 and smaller, and are used for offshore sailing between distant coastal ports and for plotting the navigator's position out of sight of land. They show offshore soundings and the most important lights, outer buoys, and natural landmarks which are visible at considerable distances.

The suitability of chart scale depends on many factors, the most important of which is the need to locate all significant bottom features. Other factors which must be considered include (1) purpose of the chart, (2) scale of the survey which is never smaller than the chart, (3) geographical features and other navigational aids, (4) scales of existing or proposed overlapping charts, and (5) importance of the area to shipping and other interests.

State of Revision—The up-to-date status of information portrayed on the chart can be partially determined by inspection of the various chart dates exhibited. Most charts show information in a reasonably

standardized format along the bottom margin, which indicates the date of publication in terms of new edition, large correction, and small corrections or revised printings. In addition, the credit line in the title provides the year in which the original survey or chart was made, whereas the compilation sources note usually lists the charts used. Finally, charts are hand-corrected for changes in the *Notice to Mariners* published prior to the date of the chart's distribution. The date of the latest *Notice* issue for which hand corrections have been made is stamped in the margin. Important changes after the date of the latest hand-corrected changes are published in the weekly *Notice to Mariners* and should be applied by the chart user.

Comparison with other data—The overall status of revision necessary on charts cannot be determined, of course, without making a field edit or comparing other charts, maps and photography of known reliability, plus intelligence files, and related data. New data do not necessarily supersede completely older information. The extent to which hydrographic detail remains current depends on the character of the coast; for example, a rocky bottom remains fairly stable over the years, whereas shoals, banks, and estuaries sometimes change seasonally. It is obviously infeasible to attempt to classify the various degrees of revision that may be necessary. Consequently, the major chart features are evaluated, in terms of data significant to the safety of navigation, as either being in need of revision or not.

Legibility—The degree of clarity achieved in delineating and symbolizing on charts the featured characteristics of an area is important. Factors such as number of colors, scales, symbols, graticules, or size and placement of type do not materially affect the reliability of a chart, but their clarity of portrayal, e.g., exact color registration, consistent treatment, and standard symbols profoundly affect the chart's legibility.

CONCLUSIONS

At present there is no standard evaluation system or terminology although the general terms good, fair, and poor are often used in regional chart studies. These terms are too indefinite and give rise to uncertainty.

How effective the proposed evaluation system becomes is dependent upon its implementation by the major hydrographic services throughout the world. If acceptable in principle, it may be feasible to print the results of the evaluation on the chart in a modified form of note or reliability description (Figure 3). The explanation of the alphabetic-numeric and adjective codes (Appendix, with Annex A) will be submitted to interested charting nations for consideration as a standardized procedure. In the interim, the addition of more specific references to compilation sources by means of a note or diagram (Figures 1 and 2 respectively) will increase the users' appreciation of the chart.

The ultimate in chart evaluation is to accomplish an analysis of the chart by competent analysts prior to its lithographic stages of production. The cartographer is in an excellent position to make the evaluation because the quality of sources used, the compilation techniques employed, and the rendering of the chart's characteristics by means of selection, judgment, and retention are quite fresh in his memory. Unless the evaluation is based on examination of all available sources, it will be largely a matter of conjecture regardless of the apparent completeness and accuracy of the chart.

Most important: if each producing agency were to evaluate its charts using common standards the problem would be made enormously easier because the originator's evaluation would be largely retained. If the evaluation does not appear on a source chart, then the originating nation will be consulted for the necessary information prior to incorporation of an adjective rating in the reliability diagram on a chart compilation.

The timeliness of a chart evaluation from a user viewpoint is of paramount importance. During war, for example, extraordinary demands are sometimes made for

an evaluation of chart coverage for an entire region. Whether charts are handled as one study on an area basis or individually as acquired, the application of the evaluation procedure described in the preceding pages is similar, except for certain generalizations that are more apropos on an area basis. The evaluation factors can be entered in an electronic data processing system and stored on cards for use under a variety of requirements.

The mariner can perform a real service to himself and others if he detects errors on the charts and submits as complete and accurate corrective information as practicable, including an evaluation of the reliability of the data submitted.

The evaluation system should not be too complex for operating personnel to implement; on the contrary, simplifying assumptions must be made that can be translated into approximations that are easy to use. An approximate evaluation which is used may be a great deal better than a more exact evaluation which is not.

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APPENDIX

Evaluation Criteria for Nautical Charts

For scales of 1/600,000 and larger, the criteria which determine the different categories of reliability of water and land features are divided into four classes: (1) hydrographic accuracy, (2) planimetric accuracy, (3) relief accuracy, and (4) completeness. The total evaluation is obtained by combining the separate evaluation ratings and by attaching as a suffix the year in which the evaluation of completeness was made; for example, IiA2cd,1960. Serial numbers do not appear in the evaluation results. Limits of error for nonstandard scales can be obtained pro rata from the figures at serials 1, 2, 9, 10, 13, and 14.

The criteria for hydrographic accuracy are listed at serials 1–7 in Tables 1 and 2. Roman numerals in the last column of each table denote a chart's rating based on horizontal accuracy of plotted hydrographic detail and accuracy of measured depths, respectively.

Criteria for Hydrographic Accuracy at Scales of 1/600,000 and Larger

The horizontal positions of charted soundings based on survey fixes shall fall, with 90 percent assurance, within 0.05 inch (1.27 mm) of the positions as plotted on the hydrographic survey sheet. The horizontal positions of charted navigational aids and dangers such as beacons, visible rocks, etc. shall fall, with 90 percent assurance, within 0.025 inch (0.63 mm) of the positions as plotted on the survey sheet. These criteria are based on survey positions relative to a shore control which consists of a triangulation scheme of at least third-order accuracy.

TABLE 1

Ground Distance Equivalents of Error Limits

Scale of Chart	1/25,000	1/50,000	1/100,000	1/200,000	1/250,000	1/500,000	Rating
Serials 1 Navigational Aids and Dangers	16m (52 ft)	32m (104 ft)	64m (210 ft)	128m (420 ft)	160m (525 ft)	320m (1,050 ft)	I
2 Soundings	32m (104 ft)	64m (210 ft)	128m (420 ft)	256m (840 ft)	320m (1,050 ft)	640m (2,100 ft)	II
3	Will not meet serials 1 or 2						II
4	Horizontal position accuracy undetermined						III

Criteria for Measurement of Depth Accuracy at All Scales

Charted depths based on survey measurements by echo sounder or leadline (reduced to a tidal reference plane on the continental or insular shelf) shall fall, with 90 percent assurance, within the limits of error set out below.

TABLE 2

Serials	Soundings of 0–11fm (0–20m)	Soundings of 11–55fm (20–100m)	Soundings of 55fm (100m) and deeper	Rating
5	1.0 ft (0.3m)	3 ft (1.0m)	1% of depth	i
6	Will not meet serial 5			ii
7	Depth measurement accuracy undetermined			iii

The horizontal positions of well-defined planimetric features based on controlled surveys shall fall, with 90 percent assurance except where unavoidably displaced by exaggerated symbolization, between 0.02 inch (0.5 mm) and 0.04 inch (1.0 mm) of the positions as plotted on the topographic or photogrammetric survey sheet. The foregoing criteria are given in terms of error limits on the chart; the criteria set out below, in terms of error limits on the ground.

TABLE 3

Ground Distance Equivalents of Error Limits

Scale of Chart Serials	1/25,000	1/50,000	1/100,000	1/200,000	1/250,000	1/500,000	Rating
9	12.5m (41 ft)	25m (82 ft)	50m (164 ft)	100m (328 ft)	125m (410 ft)	250m (820 ft	A
10	25m (82 ft)	50m (164 ft)	100m (328 ft)	200m (656 ft)	250m (820 ft)	500m (1,640 ft)	B
11	Will not meet serials 9 and 10						C
12	Planimetric accuracy undetermined						D

The criteria for relief accuracy are listed at serials 13–17 in Table 4. The rating in Arabic numbers denotes a chart's classification in terms of the accuracy of relief portrayed.

Criteria for Relief Accuracy at Scales of 1/600,000 and Larger

Ninety percent of the elevations taken from the chart and elevations of points interpreted from charted contours will depart from the surveyed elevation by no more than the errors set out below. In checking elevations taken from the chart, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error mentioned for serials 9–10.

TABLE 4

Scale of Chart

Serials	1/25,000	1/50,000	1/100,000	1/200,000	1/250,000	1/500,000	Rating
13*	5m (16 ft)	10m (33 ft)	20m (66 ft)	40m (131 ft)	50m (164 ft)	100m (328 ft)	1
14*	10m (33 ft)	20m (66 ft)	40m (131 ft)	80m (262 ft)	100m (328 ft)	200m (656 ft)	2
15	Relief shown only by approximate contours, form lines, hachuring or shading						3
16	Relief not shown						4
17	Relief accuracy undetermined						5

* See following paragraphs

The contour interval that is appropriate will not only vary with the chart scale, but also with the terrain. For example, the normal contour interval in use at 1/25,000 scale is 10 meters or 25 feet although the optimum contour interval may vary from 5 feet in the flat country to 80 feet in mountainous country. Charts which show contours at wider intervals than is appropriate for the scale in order to depict shaded relief may be rated "1" or "2" depending on all the factors concerned.

The criteria for relief accuracy given at serials 13 and 14, may be replaced by the following as an alternative:

Rating	1	2
Limits of error in terms of the appropriate contour interval (as given in preceding paragraph) in use at the scale.	Half contour interval	Contour interval

Criteria for completeness at chart scales of 1/600,000 and larger are listed at serials 18–19 in Table 5. The alphabetical rating, plus the year in which the evaluation was made, denotes a chart's status with respect to the various completeness factors.

TABLE 5

Serials	Completeness Criteria for Scales of 1/600,000 and Larger	Rating
18	Chart meets criteria for completeness, up-to-dateness, standardization, and legibility (give date of evaluation).	x,19—
19	Chart needs revision of one or more of the items indicated below in order to meet standards of serial 18. (Give date of evaluation.)	
	a. Items needing revision undetermined	a,19—
	b. Cultural information (to the extent required on charts)	b,19—
	c. Hydrography (including tide & current data as required)	c,19—
	d. Magnetic variation	d,19—
	e. Vegetation (mangrove, marsh, rice, conspicuous trees, etc.)	e,19—
	f. Bottom characteristics	f,19—
	g. Acceptable scale	g,19—
	h. Place names	h,19—
	j. General legibility	j,19—
	The items deficient or requiring revision are indicated in the evaluation category by the appropriate letter suffix or suffixes.	
	Examples:	
	In a 1960 evaluation, revision of the chart is considered to be necessary but the specific items requiring revision are not determined.	
	In a 1959 evaluation, revision of culture to show new port facilities is required. Also, the scale is too small for a harbor chart, and place names are not treated in accordance with official usage.	a,1960 bgh,1959

For chart scales smaller than 1/600,000, general criteria and a single letter rating are adopted in Table 6. These charts are invariably derived from larger scale charts, and the criteria of the latter are not too applicable. The separate criteria of serials 20–22 have therefore been adopted.

TABLE 6

Serials	General criteria for scales smaller than 1/600,000	Rating
20	Hydrographic, planimetric, and relief information up to date and complete for scale. (Give date of evaluation.)	A,19—
21	Hydrographic and relief information generally up to date. Planimetric information incomplete or relatively out of date. (Give date of evaluation.)	B,19—
22	Hydrographic and relief information not shown correctly. Recompilation or a major revision is necessary to produce a Class A or Class B chart. (Give date of evaluation.)	C,19—

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ANNEX A TO APPENDIX

Expression of Evaluation on Nautical Charts

An evaluation of each chart source may be indicated on a chart by an adjective rating system which is equivalent to the alphabetic-numeric code outlined in the preceding pages. Figure 3 illustrates the use of adjectives with each source cited in the Reliability Diagram. In the following table examples of ratings are given, but other combinations of letter-number ratings are possible which result in the same adjective equivalents: Good-Usable, etc.

Charts at scales of 1/600,000 and Larger

Rating Example	Adjective Equivalent	
IiA1x	Excellent-Adequate	Chart meets all standards for accuracy of hydrography, planimetry, and relief; and all standards for completeness.
IiA1b . . .	Good-Adequate	Chart meets same accuracy standards as above, but requires revision to meet one or more standards of completeness.
IiiB2x	Good-Usable	Chart meets at least secondary standards for accuracy of hydrography, planimetry, and relief; and all standards for completeness.
IiiB2b . . .	Fair-Usable	Chart meets at least secondary standards for accuracy as above; and requires revision to meet one or more standards of completeness.
IIiiC3bc . . .	Poor-Inadequate	Chart does not meet secondary standards for accuracy; or requires recompilation or major revision to correct deficiencies in completeness standards.
IIIiiiD5a	Undetermined	Chart is of undetermined accuracy that may or may not meet standards for completeness.

Charts at scales smaller than 1/600,000

Rating	Adjective Equivalent	
A	Good-Adequate	Chart with hydrographic, planimetric, and relief information up to date, complete, and legible commensurate with scale.
B	Fair-Usable	Chart with hydrographic and relief information reasonably up to date, but planimetric detail incomplete or relatively out of date.
C	Poor-Inadequate	Chart with hydrographic and relief information incomplete or out of date. Recompilation or major revision necessary.

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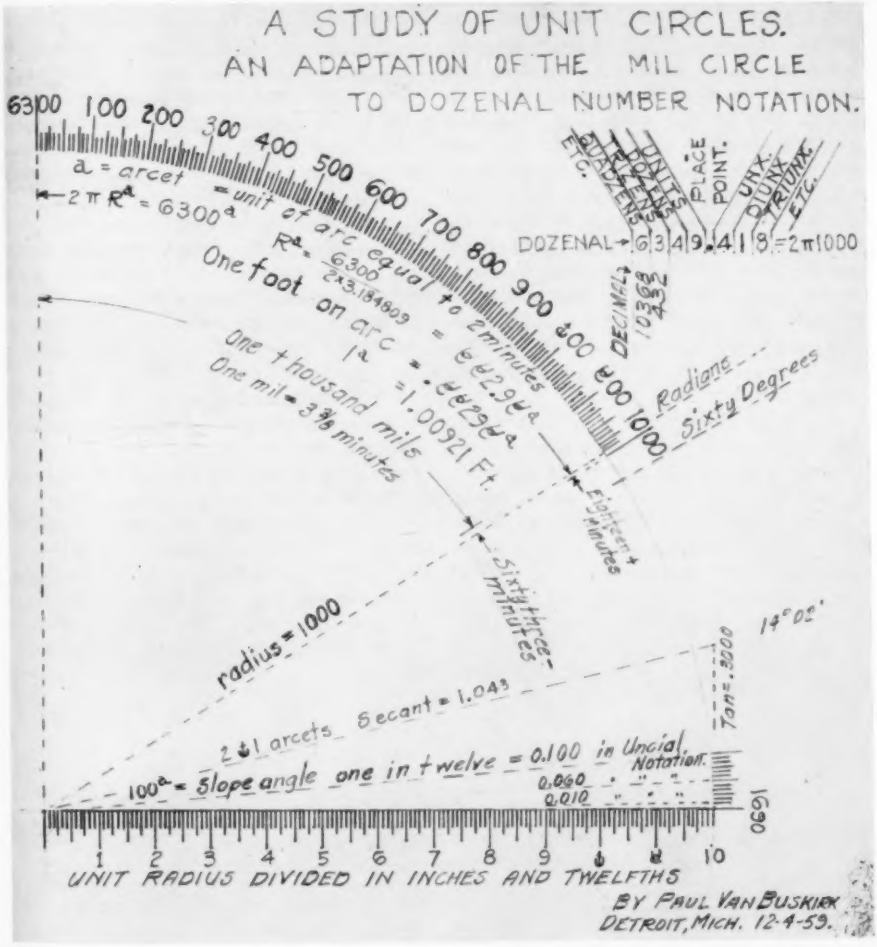
The Unit Circle

By PAUL VAN BUSKIRK*

OUR mathematical concept of the circle traces back to the Sumerian division of about 2500 B.C. It was the six part division by the radius used as a chord. The points were numbered from one through six.

The Babylonians expanded this division according to their habit of dividing units into 60 parts. The unit 1 still remained in the Sumerian order and the sixtieths were regarded as fractions. The circumference was known to be $6^{17}/_{60}$, which reduces to 6.2833 . . . instead of our 6.2832. The arc in the first sector was therefore $1^{17}/_{360}$ and

* Registered Civil Engineer, 1750 Guardian Building, Detroit 26, Michigan.


A STUDY OF UNIT CIRCLES.
AN ADAPTATION OF THE MIL CIRCLE
TO DOZENAL NUMBER NOTATION.
6300 100 200 300 400 500 600 700 800 900 A00 B00 1000
a = arcet = unit of arc equal to 2 minutes
2πR^a = 6300^a
R^a = 6300 / 2x3.1415909 = 6692.96^a
One foot on arc = .6692.96^a = 1.00921 Ft.
One thousand mils = 3⅜ minutes
One mil
Radians
Sixty Degrees
Eighteen +
Sixty three minutes
radius = 1000
14° 02'
2 ⅛ arcets Secant = 1.043
Tan = .2500
100^a = Slope angle one in twelve = 0.100 in Uncial Notation.
0.060
0.010
1690
DOZENAL → 6 3 4 9 . 4 1 8 = 2π1000
DECIMAL 10368 432
PLACE POINT.
UNIT DOZEN GROSS ETC.
UNIT DIZNY TRUNK ETC.
1 2 3 4 5 6 7 8 9 ↊ ↋ 10
UNIT RADIUS DIVIDED IN INCHES AND TWELFTHS
BY PAUL VAN BUSKIRK
DETROIT, MICH. 12-4-59.

the radian point fell at exactly 1. There is no evidence that they used the radian concept.

This circle passed to the Greek and Egyptian civilizations, but the *60th* fractions came to be treated as *360ths* of the whole circle. In time these fractions came to be regarded as "units" of circular measure. Under the decimal notation, the Sumerian 1 was displaced by 60, and the circle lost its original "sixness."

During the Napoleonic era the circle was divided into 1,000 parts. The United States Army adopted this circle about the same time the chain of 100 feet came into use. Later the U. S. Artillery Corps developed the mil circle of 6,400 divisions, and it displaced the decimal circle for Army use. This was actually a return towards the original Sumerian concept, as its virtue lay in making the radian point close to the 1,000th graduation. This circle was in use almost a century, as the ordinary soldier could readily grasp the fact that one graduation meant a gun elevation of one yard at a range of 1,000 yards. This was only a close approximation, however, and modern demands for precision have tended to displace the mil circle.

It is interesting to note the impact of the changing number concepts on this problem. When it is carried on in terms of the twelve-digit system, where *t* is the tenth "digit," *ε* is the eleventh, and 10 stands for a dozen, 100 a dozen-dozen, etc., is is possible to restore the original "sixness" to the circle. The illustration uses this notation for whole numbers and "unical" fractions.

The dozenal number for 6.25 is 6.3, much nearer 6.2832 than was the 6.4 used as the mil-circle base. Expanding dozenal 6.3 by three places, we get a number that represents 10,800, which is ½ the number of minutes in the customary circle. Calling this 2-minute quantity an "arcet" and drawing the 12 arcet lines, we find that the 1,728th arcet line falls 18.2532 minutes beyond the radian boundary. In the mil circle the "unit" radius was treated as 1,000 yards and in the arcet circle it should be thought of as a dozen-dozen-dozen (quad-zen) feet. Therefore, the arcet is almost exactly 1 foot in 1,728 feet, expressed as 0.001 slope angle on the lower part of the drawing.

The surveyor's chain increased from 66 feet to 100 feet during the last century. During this century it should increase from 100 feet to 144 feet, divided into inches and twelfths of inches, all in place value notation. Leveling rods and shop rules should be graduated in this pattern.

Then the table of arcet tangents would give rises directly, the secant table would give slope distances, and roof-truss plans could be made without 1/16 and 1/32 inch notations. Fabrication would proceed as now, with no change in drills, bolts, rivets, etc., as will be required if we stand still until forced into adoption of the metric system by pressures that are becoming more powerful each year.

This paper can not go into all the trains of thought aroused by the unit-circle concept. Is only the radius to be unity? In the 1,000 circle the circumference also was unity, but that did not seem popular, even with the metric people. Is a radian a unit? Is a degree a unit? Is the radian sector a better comparator figure than the whole circle?

₹ ₹ ₹

Oceanographic Expedition

The survey ship *Explorer* began an extensive oceanographic expedition enroute from Seattle, Washington, by way of the Panama Canal to Norfolk, Virginia, starting the first of February, 1960. This modern oceanographic cruise is the first full-scale expedition of its kind undertaken by the Coast and Geodetic Survey since the historic oceanographic surveys made by the ship *Blake*, in the early 1880's.

The *Explorer* is being reassigned for service along the east coast of the United States and will extend her normal transfer time from the west to the east coast by more than two months in order to investigate various oceanographic features along the route. Her place in the Alaska survey fleet will be taken by the new ship *Surveyor*.

The expedition was supported in part by a

(Continued on page 386.)

New Ship SURVEYOR

By REAR ADMIRAL H. ARNOLD KARO

DIRECTOR, U. S. COAST AND GEODETIC SURVEY

THE U. S. Coast and Geodetic Survey Ship SURVEYOR was commissioned on April 30, 1960, at San Diego, California, where she has been under construction for the past two years. This modern ship is among the finest of the specially built survey ships in the world. She will now become the backbone of the Coast and Geodetic Survey fleet, joining other units operating in the 2½ million square miles of United States continental margins extending from the icy waters of Alaska to the tropical regions of the Caribbean and the Pacific Ocean.

This newest addition to the Coast and Geodetic Survey fleet is a twin-masted, single-screw, steel ship with an over-all length of 292 feet 2 inches, beam of 46 feet, displacement under full load of 3,130 tons, standard displacement of 2,600 tons, and light displacement of 2,070 tons. The full-load draft of the ship is 16 feet. The main propulsion unit, weighing 82,500 pounds, consists of high- and low-pressure turbines capable of delivering 3,520 maximum continuous shaft horsepower. The turbines are equipped with double helical and double reduction gears. The exhaust casing of the low-pressure turbine has a built-in, high-pressure element for astern operation.

Steam power is furnished by two sectional header marine boilers with total normal steaming rate of 35,000 pounds per hour with a maximum rating of 52,500 pounds per hour. These two *Combustion Engineering* boilers are equipped with economizers

U. S. Coast and Geodetic Survey Ship *Surveyor*.

and steam air heaters. Auxiliary functions of the ship are provided by about 100 Westinghouse motors ranging up to 50 horsepower each. The Westinghouse Company also supplied the electrical control equipment for auxiliary installations. The ship carries a No. 7 Hyde electro-hydraulic, vertical-type windlass and a 21-inch Hyde electric warping capstan. Rotary gear type pumps are used for fuel oil transfer and also for transfer of diesel and lube oil. Rotary screw type pumps are employed for fuel oil service. Special type distillation equipment is included. The ship is humidity controlled and air conditioned.

The latest electronic navigational and hydrographic equipment is aboard the SURVEYOR, including gyro and auto-pilot, Main Ship Radar, Loran Receiver, Dead Reckoning Analyzer, Radio Direction Finder, Auxiliary Ship Radar, and an Electro-Magnetic Log. The Dead Reckoning Analyzer is particularly useful when in areas of doubtful Loran reception to eliminate any improper fixes. The Electro-Magnetic Log operates under the principle of the distortion of the electro-magnetic waves by the water current. The range of this instrument is 0 to 40 knots in increments of 0.01 knot.

For hydrography, the hydrographic officer can use EPI for offshore surveys to 400 miles, the DM 100-watt Raydist for accurate control up to 175 miles, and Shoran for inshore charting. For launch surveys, the Shoran or the DM 10-watt transistorized Raydist will be used. The ship carries three hydrographic launches equipped with portable depth recorder, Shoran, and transistorized Raydist, and single side band communication equipment. Extra heavy generating equipment has been included to power the above equipment.

Three portable depth recorders are used to obtain detailed sounding of 0 to 1,500 feet in expanded scales of 55 feet. For deep work to 36,000 feet an EDO type UQN–1D in conjunction with a Precision Depth Recorder (PDR) is used for detailed echo sounding. The PDR has an expanded scale of 400 fathoms for 18 inches of chart paper. All of the echo sounders mentioned above are connected to a 60-cycle tuning-fork precision frequency power supply for accurate speed control.

Oceanographic equipment on the new ship includes devices for measuring currents and water temperatures; for obtaining water samples at various depths and samples of bottom sediments. The current measuring equipment includes Roberts radio current meters and buoys, the latter being equipped with receiver-transmitters and selector switches for sending coded data relative to velocity and direction at multiple depths upon request from the ship or shore station. The velocity and direction signals for each depth are transmitted on separate frequency modulation channels and are recorded with reference to time by a three-stylus chronograph. The ship also has Price current meters and poles for near-surface current measurements. Nansen-bottle equipment with attached reversing protected and unprotected deep-sea thermometers provide water samples and water temperatures at various depths. Shallow, medium, and deep bathythermographs furnish continuous traces of the vertical temperature gradient to depths of 900 feet. Metallic-coated slides used in the bathythermographs are a decided improvement over the smoked slides previously used. Phleger corers are used for obtaining samples of bottom sediments.

The SURVEYOR has a service speed of 15 knots and a cruising endurance of 10,500 miles. The trial runs made prior to final acceptance of the ship, however, indicated that the cruising range is extended to about 20,000 miles at a speed of 12 knots. In addition to the three 36-foot hydrographic launches, the ship also carries a 36-foot landing craft and four 26-foot motor whaleboats. The SURVEYOR has a crew of 21 officers and 90 men.

The keel for the new ship was laid at San Diego during February 1958 by the National Steel and Shipbuilding Corporation. Built on a strong and sound keel, this rugged ship is well equipped to explore uncharted waters while facing nature's most violent storms. The SURVEYOR was launched at the National Steel and Shipbuilding Corpo-

ration's shipyard at San Diego on April 25, 1959.

The new, modern $6 million ship is one of the most elaborately outfitted research ships in the world. In addition to the most advanced electronic surveying equipment, she is also equipped with photographic and oceanographic laboratories. Facilities will eventually be included for preliminary reproduction of field survey sheets to provide advance information on areas of particular importance.

Commissioning of the new ship is especially timely in view of national attention being given oceanographic investigations and developments. The SURVEYOR will be used effectively in furthering the modern oceanographic studies that are being programmed by the Coast and Geodetic Survey. This new component of the surveying fleet will accept the challenging tasks that lie ahead as the Nation's oceanographic program gathers momentum. Surveying will now be accelerated of the seaward margins of the United States, involving an area greater than the entire continental land area of the Nation. The coastlines of the United States represent many thousands of miles of tidal shoreline, including the enormous reaches of the new States of Alaska and Hawaii.

The new SURVEYOR is the latest of a long line of Coast Survey ships, beginning with the JERSEY in 1834 and the EXPERIMENT in 1835. The brig WASHINGTON and the schooner MATCHLESS made historic contributions to the prestige of the Coast and Geodetic Survey in surveying the coastal waters of the Nation. The WASHINGTON was the first Coast Survey vessel used extensively in oceanography, more than 100 years ago. The MATCHLESS was among the last of the sailing ships used in Coast Survey work about the turn of the century. The modern survey ships of the Bureau, fully equipped with the latest type surveying instruments, make possible the more critical modern surveys needed to produce up-to-date nautical charts to meet our present-day maritime demands.

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Surveying and Mapping Literature

Members are requested to send in surveying and mapping news items for publication in Surveying and Mapping.—Editor.

MAGAZINE ARTICLES

General Interest

DEVELOPMENT OF MARGINAL LANDS IN SAN FRANCISCO. Michael Praszker. *Civil Engineering*, Vol. 30, No. 2, February 1960. (Engineering details of the West Twin Peaks and Mira Loma Park real estate developments utilizing idle hillside terrain.)

HYDROGRAPHIC SURVEYING—THE WAY AHEAD. Rear Admiral K. St. B. Collins, Hydrographer of the Royal Navy. *The Canadian Surveyor*, Vol. 15, No. 2, March 1960. (Emphasizes continuing need for international cooperation in hydrographic surveying activities.)

THE INTEGRATION OF SURVEYS AND ITS REQUIREMENTS. T. J. Blachut. *The Canadian Surveyor*, Vol. 15, No. 2, March 1960. (Review of problems involved in needed integration of surveying and mapping activities.)

MUNICH, A CENTER OF GEODESY IN GERMANY. M. Kneissl. *Bulletin Geodesique*, New Series, Year 1960, No. 55, March 1. (Short treatise including discussion of the major problems of geodesy, an historical survey, and a review of the development of geodesy in Germany.)

DATA PROCESSING FOR THE SOUTH WITH IBM 704 AND 650 COMPUTERS. *Texas Engineering Experiment Station News*, Vol. 11, No. 1, March 1960. (Illustrated description of Texas A. and M. Systems Data Processing Center and the equipment employed.)

THE SINO-INDIAN FRONTIER DISPUTE, A GEOGRAPHICAL REVIEW. William Kirk. *The Scottish Geographical Magazine*, Vol. 76, No. 1, April 1960. (General review of the problem in which it is pointed out that lack of accurate official maps contributes to the difficulty.)

CHANGES IN SURVEYING AND MAPPING LAWS IN NORTH CAROLINA. M. V. Smirnoff. *North Carolina Engineer*, Vol. 16, No. 3, April 1960. (Review of enactments of 1959 General Assembly looking toward Statewide unification of surveying and mapping practices.)

A HISTORY OF THE BEACH EROSION BOARD. Major General Walter K. Wilson, Jr., and Richard O. Eaton. *Shore and Beach*, Vol. 28, No. 1, April 1960. (Traces the development of the Board from humble beginning in 1929 to the present.)

A NEW COURSE FOR THE COLORADO. James B. Sullivan. *Engineering News-Record*, Vol. 164, No. 20, May 19, 1960. (More about the struggle between Arizona and California for additional water from the Colorado River.)

WHY THE QUANTITY SURVEYOR? William James. *The Chartered Surveyor* (Journal of the Royal Institution of Chartered Surveyors), Vol. 92, No. 11, May 1960. (General discussion of a profession long developed in England to support construction projects of all kinds, with comments on the question "would the British pattern of quantity surveying, or some variant of it, be beneficial in the U. S. A.?")

Cartography

A SPIRAL TRANSFORMATION FOR THE CONICAL ORTHOMORPHIC PROJECTIONS, AND A GRAPHICAL CONSTRUCTION. Frank George. *Empire Survey Review*, Vol. 15, No. 115, January 1960. (Mathematical discussion.)

A REVIEW OF SOME RUSSIAN MAP PROJECTIONS. D. H. Maling. *Empire Survey Review*, Vol. 15, No. 115, January 1960. (Mathematical descriptions of a number of projections devised by Russian geodesists and cartographers.)

GEOGRAPHIC PLACE NAMES. Col. L. Sebert. *The Canadian Surveyor*, Vol. 15, No. 2, March 1960. (Review of the problems involved in applying place names on maps for English speaking users.)

HISTORY IN A MAP. E. M. Yates. *The Geographical Journal*, Vol. 126, Part I, March 1960. (Use of maps to study historical geography of areas which have undergone extensive changes in landscape.)

THE MAP ROOM OF THE ROYAL GEOGRAPHICAL SOCIETY. G. R. Crone and E. E. T. Day. *The Geographical Journal*, Vol. 126, Part I, March 1960. (An account of the history of its development and a brief description of its contents.)

HILLSHADING FOR RELIEF DEPICTION IN TOPOGRAPHICAL MAPS WITH SOME RECENT APPLICATIONS. L. J. Harris. *The Scottish Geographical Magazine*, Vol. 76, No. 1, April 1960. (Traces development of various methods and theories of hillshading and discusses recent work on the problem in the British Ordnance Survey.)

MAPS, CHARTS AND COPYRIGHT. Abraham L. Kaminstein. *Special Libraries*, Vol. 51, No. 5, May–June 1960. (The Chief, Examining Division, Copyright Office, Library of Congress reviews the copyright law as applied to maps and charts.)

COPYRIGHT—THE PUBLISHER'S VIEWPOINT. Paul B. Lee. *Special Libraries*, Vol. 51, No. 5, May–June 1960. (The assistant to the president, General Drafting Company, discusses the problems involved in detecting and guarding against infringement of map copyright.)

REPRODUCTION—CURRENT PRACTICES IN MAP LIBRARIES. Alton P. Juhlin. *Special Libraries*, Vol. 51, No. 5, May–June 1960. (Results of a survey of policies adopted by various libraries throughout the United States.)

Control Surveys

CHARTS FOR THE REDUCTION OF HEIGHTS FROM ANEROID READINGS BASED ON A STANDARD ATMOSPHERE AND A STANDARD LAPSE-RATE. J. C. Bhattacharji. *Empire Survey Review*, Vol. 15, No. 115, January 1960. (Definitions and demonstration of method.)

BASE MEASUREMENT IN SOUTHERN SUDAN. D. F. Munsey. *Empire Survey Review*, Vol. 15, No. 115, January 1960. (Description of field work by the Sudan Survey Department in connection with the completion of the arc of the 30th meridian by the Army Map Service.)

SYMPOSIUM ON THE AVERAGE LEVEL OF THE SEAS OF WESTERN EUROPE, LIVERPOOL, OCTOBER 1959. *Bulletin Geodesique*, New Series, Year 1960, No. 55, March 1. (Introduction in French by J. J. Levallois followed by eleven articles in English on various phases of oceanographic leveling.)

GEODETIC BEACON PLANNED FOR TRANSIT IB. Philip J. Klass. *Aviation Week and Space Technology*, Vol. 72, No. 17, April 25, 1960. (Describes "hitch-hike" precision tracking system, expected to permit correlation of different national geodetic datums and providing more accurate data on the relative location of cities, islands, and landmarks around the world, planned as an experiment aboard the Navy's IB navigation satellite due for launching later in the year.)

Education

ENGINEERS, ATOMIC PHYSICS, AND MATHEMATICS. E. R. Harrington. *Civil Engineering*, Vol. 30, No. 2, February 1960. (Reassertion of the professional status of the civil engineer.)

COLLOQUIUM NEWS. *The Canadian Surveyor*, Vol. 15, No. 2, March 1960. (Several articles on progress in the field of surveying education resulting from the 1959 colloquium on the subject.)

Instruments

A COMPARISON OF THE SPECIFICATIONS OF SOME CATEGORIES OF THEODOLITES AND LEVELS. G. H. Halliday. *The Journal of the Institute of Mine Surveyors of South Africa*, Vol. 11, No. 1, March 1960. (General discussion of six types of instruments, accompanied by charts of their specifications.)

SURVEYING INSTRUMENTS IN MILS. John J. Durkin. *Civil Engineering*, Vol. 30, No. 6, June 1960. (Describes modification at the U. S. Engineer Research and Development Laboratories, of two popular Wild theodolites graduated in mils as advocated by Philip Kissam in 1942.)

Property Surveys

THE ADJUSTMENT OF SEMI-PRECISE TRAVERSES. B. Chiat. *Empire Survey Review*, Vol. 15, No. 115, January 1960. (Describes method of correction for scale.)

PLANE CO-ORDINATES FOR SURVEYORS. J. E. Lilly, Dominion Geodesist. *The Canadian Surveyor*, Vol. 15, No. 2, March 1960. (Discussion of the over-all question of coordinates and the problems involved in applying plane coordinates to the earth's surface.)

THOSE GOOD OLD DAYS. J. E. Jackson. *The Canadian Surveyor*, Vol. 15, No. 2, March 1960. (Reminiscences of a veteran surveyor of a difficult operation in northern Manitoba undertaken in 1913.)

BOOKS AND PAMPHLETS

THE PLANNING AND DESIGN OF HILLSIDE SUBDIVISIONS. L. Gerkin. Speech included with a release from the Engineering Service Corp., 1127 W. Washington, Blvd., Los Angeles 15, California. iii and 12 pp.

STATE OF LOUISIANA, DEPARTMENT OF PUBLIC WORKS, BIENNIAL REPORT 1958–1959. Baton Rouge, 1960. 234 pp., illus., tables, maps.

TENNESSEE, BOARD OF ARCHITECTURAL AND ENGINEERING EXAMINERS, ROSTER, 1960. Nashville, 1960, 197 pp.

SOVIET GEOGRAPHY: REVIEW AND TRANSLATION. Theodore Shabad, Editor. Vol 1, No. 4, American Geographical Society, New York, April 1960. 88 pp., maps.

THE ARMY MAP SERVICE, ITS MISSION, HISTORY AND ORGANIZATION. Corps of Engineers, U. S. Army, Army Map Service, Washington 1960. 41 pp., illus.

LYMAN D. LYNN

Coast and Geodetic Survey

Distinctive Recent Maps

Die Grossen Militärischen Paktsysteme der Welt, gives the status of the several military pacts, as of January 1, 1960. It is a publication of the K. Wenschow firm of Munich, Germany. Different colors designate countries which are associated with NATO, SEATO, CENTO, the USA pact, the Soviet bloc, and the Warsaw pact. The scale of the map is 1 : 27,500,000, and the sheet measures 36 × 50 inches.

Plant Hardiness Zone Map [of the United States], is a recent publication of the Agricultural Research Service, U. S. Department of Agriculture. The map shows in moderate detail the expected minimum temperatures of most of the horticulturally important areas of the United States (excluding Alaska and Hawaii) and Canada. It shows 10 different zones, each of which represents an area of winter hardiness for certain ornamental plants. The map is at the scale of 1 : 7,500,000 and measures 20 by 28½ inches. Copies may be ordered, at 15 cents each, from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Principal Potato Producing Areas of the United States is a publication of the Maine Department of Agriculture, Augusta, Maine. The attractive colored map measures 19½ by 28 inches. It was prepared from information compiled by workers of the Golden Nematode Control Project under the supervision of the U. S. Department of Agriculture. Different colors designate winter, early spring, late spring, early summer, late summer, and fall harvest areas. Gross production and percentage of U. S. crop figures are given for each State.

The U. S. Coast and Geodetic Survey has issued the second in its new series of Small-craft Charts (Series-140). It charts the coastal waterways from Fort Pierce to Miami Florida. Like the early Potomac River set, it is designed for easy reference and plotting in close quarters and emphasizes the information of special interest to operators of small craft. There are four charts which are folded and joined with a spiral binding. The price is two dollars per set. Eventually the Coast Survey plans to have some seventy sets of small craft charts.

The South Carolina Independent Telephone Association [Columbia, S.C.] published in 1960 a *Telephone Map of South Carolina*. It is at the scale of 1 : 625,000 and measures 24 by 30 inches. The areas served and headquarters of forty-seven companies are shown. There is also an alphabetical list of the companies.

The U.S. Geological Survey published, in May 1960, a new *Topographic Map of the Island of Oahu, City and County of Honolulu, Hawaii*. The scale is 1 : 62,500 and the size is 37 × 48 inches. The map, a six-color contour edition, shows forest cover and forest reserves, volcano craters, mountain peaks and ridges, streams, harbors, beaches, rocks and shoals, military reservations, and populated places. Copies of the map are available, at 75 cents, from the Geological Survey, Denver, Colorado, or Washington, D. C.

The *Official Airline Guide* (139 N. Clark St., Chicago 2, Illinois) distributed as a supplement to its November 1959 issue, an *Airline Map of Central America and South America*. The map, at the scale of 1 : 10,000,000 was copyrighted by American Aviation Publications, Inc., and lithographed by Rand McNally and Company. There are inset maps of the West Indies, Central America, and enlargements of the region between São Salvador, Brazil, and Buenos Aires. The map is 39½ by 32 inches.

República Argentina is a hypsometeric physical-political map published, in 1959, by Argentina's Instituto Geografico Militar. The map, at the scale of 1 : 2,500,000, is printed on two sheets each measuring 34 by 42 inches. There are inset maps of Buenos Aires and environs and the segment of Antarctica claimed by Argentina.

Novo Distrito Federal presents, at the scale of 1 : 100,000, Brazil's new Federal District and the surrounding region. The map, which shows contoured relief, roads, railroads, and administrative boundaries, was published in 1958 by the Conselho Nacional de Geografia. There is an enlarged inset (1 : 50,000) plan of the capital city of Brasilia. The map sheet is 29 by 52 inches.

Cyprus a Landform Study, by Norman J. W. Thrower, was issued as Map Supplement Number 1, of the *Annals of the Association of American Geographers*. (March, 1960) It consists of a series of five maps of Cyprus, all printed on one 19 by 14 inch sheet, titled respectively Terrain Types, General Reference, Hypsometry, Percentage of Land in Gentle Slope, and Relative Relief. The *Annals* Map Supplements, edited by Richard Edes Harrison, are designed to provide a publication medium for special maps and studies in cartographic technique.

The National Iranian Oil Company published in December 1959 a *Geological Map of Iran* at the scale of 1 : 2,500,000. The map, which measures 31 by 31 inches, is based on the field work of the company's geologists and "all other available information up to 1957." It was printed by Orell Füssli of Zurich, Switzerland. Accompanying the map is a booklet with explanatory notes, stratigraphical tables, an index map, and a bibliography of references.

Illustrated Map of Iraq for Development Projects was compiled by A. Karim Rifaat and published by Iraq's Development Board, Ministry of Development. It measures 46 by 38 inches and is at the scale of 1 : 1,000,000. The legend includes symbols for more than 75 different types of development projects which are located on the map.

Two maps of the Mount Everest region were published in 1958 by Expeditions Françaises a l'Himalaya (1954–55), organisées par la Fédération Française de la Montagne en coopération avec le Club Alpin Français. They were printed by l'Institut Géographique National of Paris. *Esquisse Topographique de la Région de l'Everest et du Makalu,* was compiled by P. Bordet after a Royal Geographical Society map and other documents. The map, at the scale of 1 : 50,000, shows topography, elevations, drainage system, and glaciers of the region. Elevations are given for stations established by the Survey of India, the Royal Geographical Society, and the French Himalaya expedition. The elevation of Everest is given as 8848 meters.

P. Bordet and M. Latreille compiled the *Esquisse Géologique de l'Himalaya de l'Arun et de la Région de l'Everest,* which is at the scale of 1 : 250,000. Some sixteen geologic formations are delimited for the sub-Himalayas, high Himalayas, and the border regions. The map measures 23 by 16½ inches.

A *Vegetation Map of Malaysia,* at the scale of 1 : 5,000,000, was compiled by C. G. G. J. Van Steenis and published, in 1958, in collaboration with UNESCO for the UNESCO Tropics Research Project. The map, which measures 27½ by 48½ inches, shows distributions for 18 vegetation and cultivation types. It is accompanied by an 8-page descriptive booklet.

The political status of the various African entities, as of January 1, 1960, is presented on *Afrique Carte Politique,* published by France's Institut Géographique National. The scale is 1 : 10,000,000 and the size is 43 by 40 inches.

Esquisse Structural Provisoire de L'Afrique presents the provisional structural geology of Africa. The map was compiled by Raymond Furon, with the collaboration of G. Daumain, L. Dubertret, and M. Lelubre. The publisher is Association des Services Geologiques Africains, 20, Rue Monsieur, Paris 7, France. Some sixteen major formations, ranging from basic to quaternary are mapped, and structural and fault lines are indicated. The map is at the scale of 1 : 10,000,000 and measures 35 by 35 inches. It is accompanied by a 16-page descriptive booklet prepared by Furon and Daumain.

A shaded relief topographic map of the *Australian Capital Territory* is a 1959 publication of the Division of National Mapping, Department of National Development, Canberra. The map, at the scale of 1 : 190,000, includes a large area tributary to the capital city, and shows transportation routes and communication lines, mines, forests, homesteads, and churches, in addition to topography. It is 27 by 18 inches.

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The Surveyor and the Law

Remnant Rule and Proration

Dear Mr. Brown:

At the Minnesota Land Surveyors meeting in April [1960] will you comment on the Barrett-Perkins case (113 Minn 480)?

(signed) HAROLD HOFSTRAND

DISCUSSION:

Below are shown the essential data of Hughes' Addition to the City of St. Paul. The significant facts are:

(1) Lot 22 scales 50 feet more or less but not 75.38 feet as indicated.

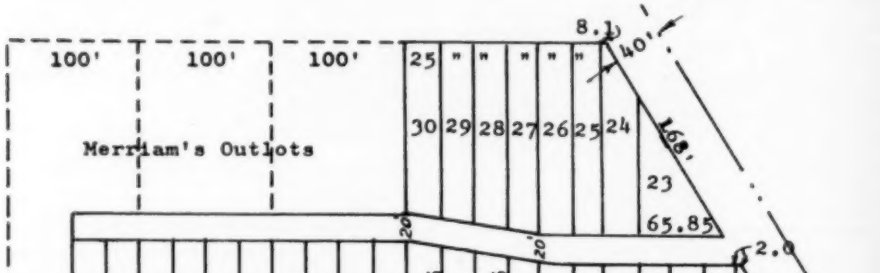
(2) The block, when measured, is 25 feet short.

(3) The court ruled that Lot 22 must take all of the shortage merely because it was irregularly dimensioned, or more specifically, it was a remnant.

Court cases should be viewed with caution. Each case is judged on its own merits. A case that is similar, yet has one point of difference, may end up with opposite results. The Barrett-Perkins case, like all other court cases, cannot be taken at its face value and extended to all other cases which by outward appearances seem to be similar,

If we are to believe the Barrett-Perkins case, which I do not, the remnant rule may be applied in Minnesota. However, the case does not spell out when the rule may or may not be applied. To apply the remnant rule, according to this case, two elements must be present and a third one is implied. First, there must be regular sequence of lots with uniform width, said width usually being in even feet. Second, there must be only one odd shaped or one irregularly dimensioned lot at the end of the block. The theory is that if the subdivider had known that there was a different block length he would have given it to the end lot, hence excess or deficiency should be given to that end lot. The implied third element, slighted, but there, is a mistake.

This remnant rule has obvious shortcomings. It is never proper to conjecture on what a man would have done had be known differently; what he did is what counts. The remnant rule is based upon a possibility, not a probability. Very few jurisdictions accept it and I am in complete agreement that it should not be used.



Hughes' Midway Add.

Why should a fully dimensioned lot be reduced in size merely because it is off shaped?

The remnant rule is like color of title in that by outward appearances it seems to be good, but actually it is not. There are numerous circumstances whereby the end lot in a block is given all the surplus or deficiency, but the reason for giving the end lot the surplus or deficiency, in my opinion, should never be attributed to the remnant rule. While the verdict in the Barrett-Perkins case was just and correct, the wording of the opinon of the judge was unfortunate.

Before going into an analysis of this case, I would like to remind you of three legal principles that all of us recognize as being correct.

First, I think that you will all agree that once a surveyor sets an original monument or line and conveyances are made calling for that monument or line, the line is fixed in position and can only be changed by resubdivision. While it is true that title lines may be altered by unwritten rights or by written conveyances, original lines, except for resubdivision or where a senior right is interfered with, are unalterable.

Second, if the original surveyor makes a mistake in recording his measurements and monuments are in conflict with his record distances, the monuments control. What the surveyor set upon the ground is proof of what he did; what he records is merely an aid to find what the surveyor did on the ground. A mistake in recording measurements does not serve as an excuse to change monument positions. If a surveyor makes a mistake in a particular lot, that mistake is left in that particular lot. To bring this principle of mistake into operation there must be sufficient evidence to show that there was a mistake and also there must be sufficient evidence to prove where the mistake belongs. A mistake, the location of which cannot be fixed, must be disposed of and proration is often applied, but a mistake that can be localized is never prorated.

Third, proration is a rule of last resort. If there is proof of where excess or deficiency belongs, then that discrepancy is placed where it occurs. If someone is designated to receive a remainder, then proration cannot apply. Proration is a means of disposing of errors, the positions of which cannot be fixed. It is not a means of distributing a discrepancy that can be proven to exist in one spot.

Below are a series of actual circumstances that illustrate the short comings of the remnant rule and also illustrate the above points.

In Figure 1 is a condition to be found along the Rancho El Cajon land grant line. It can be proven by existing monuments that the government surveyor, for some unexplainable reason, did overlap the true grant line by some 1,200 feet. In such a situation, the 1/16 corners, or, as they are sometimes called in Wisconsin, 1/8 corners, should never have been penalized by prorating from the true grant line. Corners are prorated from the location as monumented by the government, then the area lost by overlap is subtracted. The 1,200 feet of deficiency is not prorated. By appearance the remnant rule seems to apply in this circumstance, but obviously the reason for giving the deficiency to the odd lottings is because of a mistake and not because of the remnant rule.

Figure 3 illustrates this same point. Part of the Bay of San Diego was subdivided. Since title to land below the mean high tide line could not be conveyed, part of Lots F and G could not exist. Lot F was fixed in position and cannot be enlarged by proration. All the deficiency in this block was caused by a mistake (the mistake of subdividing San Diego Bay) and that mistake belongs in Lots F and G. The deficiency of some 45 feet is certainly not prorated. Here again the remnant rule seems to be applicable, but in reality it is not. A mistake caused the trouble.

Figure 2 shows a condition found to exist between San Diego and former East San Diego. The boundary between the two cities was formed by a Spanish Land Grant line. When surveying blocks within the subdivision of City Heights, all blocks except those adjoining the land grant line are found to be of record measurement; those adjoining the land grant line are 4.8 feet long. In the University Heights subdivision all blocks except those adjoining the land grant boundary are of record measurement; those adjoining the boundary are 4.8 feet short. The implication of the evidence is obvious. After the subdivisions were filed and of record, the City of San Diego improved, paved, and tie pointed Boundary Street. At the time they did this, they located the true land grant line some 4.8 feet westerly of the old line. The surveyors for the subdivisions were definitely wrong. Unfortunately this took 4.8 feet away from one side of Boundary Street and gave it to the other side. In such a situation proration from the new street line cannot apply. The lots that had their land taken away by the City must suffer the loss. Proration only applies from the original position of lots, never from a new position gained by occupancy. The remnant rule appears to be proper in this circumstance, but the

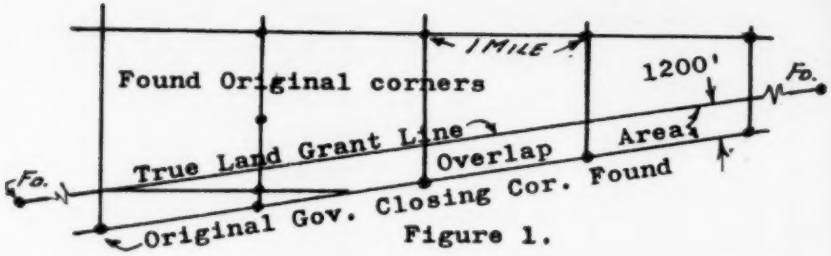


Figure 1.

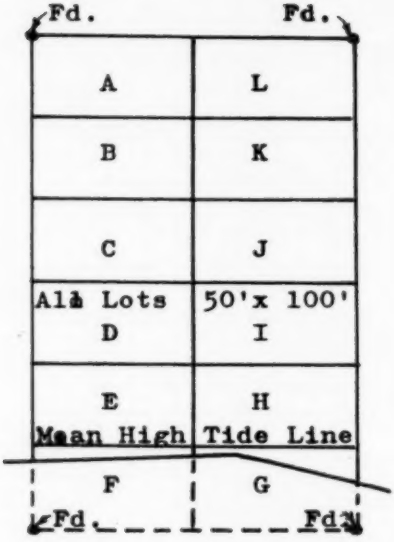


Figure 3.

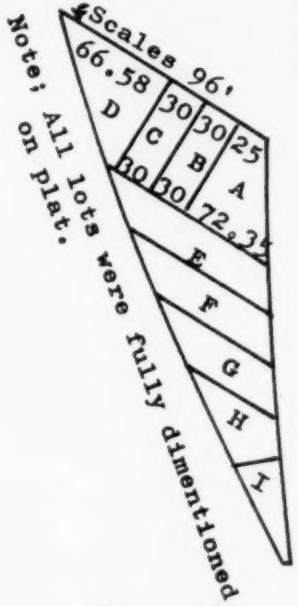


Figure 4.

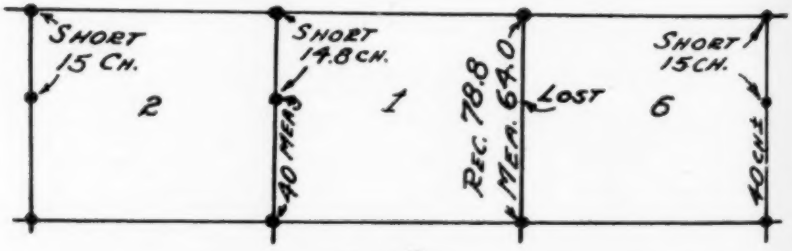


FIG. 5

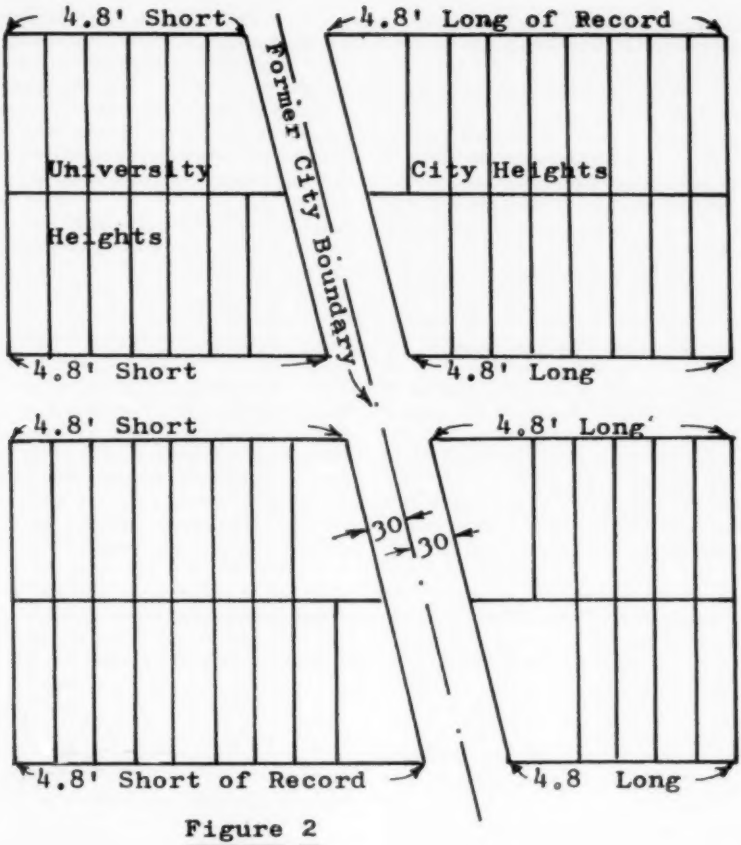


Figure 2

Note: All lots were fully dimentioned on Plat

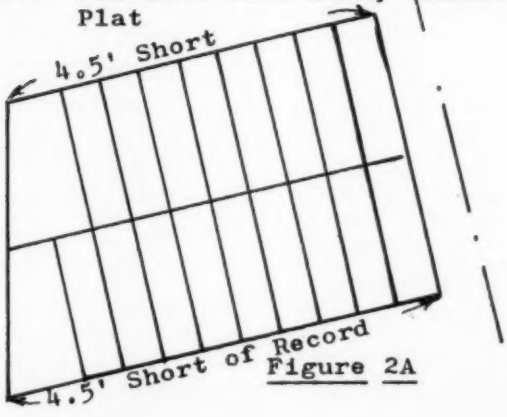


Figure 2A

real reason is adverse occupancy. While adverse occupancy can alter title lines, it can never alter original survey lines.

Figure 4 shows a situation almost identical to that found in the Barrett-Perkins case. Lot D has a dimension of 66.58 feet on the map, yet it scales 96 feet. A mathematical closure of the data shown on the original map reveals that the lot will not close by 30 feet east and west. The 66.58 feet is proven to be a mistake and should be 96.58 feet. Only a fool would try to argue that the 30 feet of excess must be prorated among all the lots. The intent from scaling the drawing and the intent as disclosed by a mathematical closure was to make Lot D 96.56 feet. Mistakes are placed where they occur and in this case it is in Lot D. The excess of 30 feet is not proratable. The reason for doing so is not because of the remnant rule—both ends of the block are remnants. The reason is because of a mistake in Lot D.

To me the Barrett-Perkins case is an identical situation. If all of you will scale the east-west dimension of Lot 22 on the map before you, you will find it to be 50 feet. To show the absurdity of the lower court's contention that the length of Lot 22 was 75.38 feet, scale off on the southerly line of Lot 22, 75 feet from the southeast corner. You will find that it falls exactly on the lot line between Lots 21 and 20. Next draw a straight line connecting this point and the most northerly corner of Lot 22 as plotted. You have a diagonal line completely out of agreement with the original subdivider's intent.

A mistake was made on the map and it is placed where it occurs, namely in Lot 22. The fact that the block is almost 25 feet short also proves this. The original subdivider made a mistake by the width of a 25-foot lot.

I am in complete agreement with the court in the final outcome of its verdict, but I do not agree with the reasoning; i.e., the application of the remnant rule. The judge noted that there was a mistake and said so. He should have stopped right there.

The syllabus in a court case is the opinion of the reporter or abstractor of the case. In this syllabus the abstractor indicates that a mistake is the cause of the trouble and because of this mistake the deficiency must fall in Lot 22. The judge in his analysis accented the idea of the last lot being a remnant, hence, so he says, the mistake is to be put in the last lot because it is a remnant. If he had said that the deficiency belongs in Lot 22 because of a mistake, he would have been on firm ground.

The remnant rule of giving surplus or deficiency to the last lot merely because it is irregular in dimension is without reason. In one block along the City of San Diego boundary line the situation is shown in Figure 2A. As pointed out, the reason for the shortage indicated is that 4.5 feet was taken from Lots 10 and 11 when Boundary Sreet was improved. According to the remnant rule every lot would be shifted 4.5 feet westerly and the shortage given to Lots 1 and 20. In such a situation the remnant rule can never apply! The deficiency must be placed where it occurs, namely in Lots 10 and 11. This is exactly the reverse of the remnant rule.

The judge in the Barrett-Perkins case did render the correct decision, but I can hardly believe that he meant his decision to apply to every case wherein a dimensioned irregular lot exists at the end of a block. The more logical view of his opinion is, "Where there is a remnant lot and the evidence supports the idea that the remnant should receive all the excess or deficiency, then place it there. But if the evidence shows that the remnant lot was to receive its full measure, it is entitled to an equal share of surplus or deficiency." Viewing his decision in this light it makes sense. You will note that one of the closing statements of the judge was, "The rule furnishes a definite and safe method and guide for *mistakes* of this type."

At law every case is judged on its own merits, and this case justified his opinion. Another one might not. To illustrate the proof of this we need only to refer to sectionalized lands. The most northerly and most westerly tiers of lottings in a township are remnants; they are what is left over. Yet the judges have uniformly refused to apply the remnant rule even in extreme cases when justice would be better served by doing so. In the case of Goroski v Tawney (121 Minn 189) the evidence was as shown in Figure 5.

Three section lines proved that the original surveyor had in fact set the ¼ corner very close to 40 chains from the section corner and that very large deficiencies existed in the closing half mile. What would be more logical than to apply the Barrett-Perkins idea in relocating the lost ¼ corner between Sections 1 and 6 and thus place the entire remnant mistake of 15.39 chains where it logically belongs, in the last half mile? But, did the court do this? Despite all the evidence that a mistake should belong in last half mile and despite the remnant rule, the lost corner position was determined by proration. The remnant rule does not apply to sectionalized lands, yet if the law were consistent

with the Barrett-Perkins case, it would. This merely points to the fact that Minnesota law can frown upon the remnant rule.

While it is true that in most instances where there is a remnant, the remnant rule does appear to apply, it is also true that in most instances there is another more logical rule for giving the deficiency to the end lot; i.e., the rule of a mistake.

In most blocks with small measurement errors, we adjust our chain to the original length of the original surveyor's chain and no problem ensues. This is the measurement index principle. But where there is a large discrepancy the chances are that a blunder was made and the entire mistake belongs where the blunder occurred.

A far better rule than the remnant rule is; "Seek the cause of surplus or deficiency, and if a mistake can be found, place the mistake where it occurs."

—Curtis M. Brown

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Photogrammetric Weeks, 1960

The Seventh Munich Photogrammetric Weeks were scheduled to begin September 26, 1960. This date was selected to enable participants to attend the International Congress of Photogrammetry in London, September 5–16, 1960, and, following the Congress, to visit also the International Training Center at Delft. The first of the Photogrammetric Weeks includes scientific lectures and demonstrations of equipment. The second, extending through to October 8, 1960, provides for practical work on plotting equipment. Sponsors are Munich Technical University, Institute of Photogrammetry, Topography and General Cartography and the Zeiss-Aerotopograph GMBH, of Munich.

Seismic Seawave Emphasizes Lurking Danger on Pacific Perimeter

The tragic events following the disastrous series of earthquakes near the coast of Chile, 300 miles south of Santiago, emphasize the potential dangers that are ever present around the entire perimeter of the Pacific Ocean. This latest explosion of nature's forces unleashed a series of monstrous waves on May 23 that swept across the Pacific Ocean with the energy that might be generated by a thousand nuclear explosions.

The violent Chilean earthquake sent shock waves racing in all directions through the earth. In less than twenty minutes after the gigantic upheaval on the ocean floor, primary earth waves activated seismological stations of the Coast and Geodetic Survey warning system at its observatories at Honolulu, Hawaii; Guam; Tucson, Arizona; and at Sitka and College, Alaska. These strong shock waves tripped alarms which alerted the observers to the fact that a major earthquake had occurred.

Information on the distance of the quake from each reporting station was radioed immediately to the nerve center of the Coast and Geodetic Survey seismic sea wave warning system at Honolulu. With this information, supplemented by data from many cooperating seismological observatories and stations, the location of the earthquake was quickly and accurately pinpointed.

Because the earthquake occurred under the sea, an advisory was issued without delay to the designated channels in the Hawaiian Islands, alerting them to the possibility of a devastating seismic sea wave. This first notice was issued about 2½ hours after the earthquake occurred. At the same time, tide station observers located at widely scattered places were alerted and requested to furnish immediately information relative to whether a seismic sea wave had been recorded on their marigrams. Reports that a tsunami had been generated were received from various tidal stations.

The system worked without a single flaw, and approximately 5½ hours before the first wave struck the Hawaiian Islands, a full emergency alert was issued to civil, military, and civil defense authorities.

While loss of life was much less than that due to the tsunami of April 1946, it is believed that more lives could have been saved if the warning to seek safety in higher elevations had been heeded. In the tsunamis of 1952 and 1957 no lives were lost because warnings were observed.

Books in Review

SURVEY ADJUSTMENTS AND LEAST SQUARES. Hume F. Rainsford. *Frederick Ungar Publishing Co.,* 1958. 326 pp. $9.50.

Hume Rainsford of the British Directorate of Overseas Surveys has compiled an excellent reference text on the analysis of errors in physical measurements and on the mathematical adjustment of geodetic data.

The opening section describes the nature of errors and problems relating to the determination of the precision of measurements. This portion of the text contains a great deal of material that was published in Wright and Hayford's classic treatment (now out of print) on adjustment of observations. This is fortunate because this fundamental theory needs to be studied by each generation.

Later chapters include examples of the various types of adjustments which must be made in processing triangulation, traverse, trilateration, and leveling networks. The author has selected a broad variety of configurations for these examples and has given rather full computational routines for many of them. His discussion and evaluation of the application of Cholesky's modification to the Gaussian elimination method for the solution of normal equations is very complete. Any person interested in numerical analysis will appreciate this chapter.

Mr. Rainsford is known to favor the use of angles over directions in the adjustment of triangulation. He uses several examples in this text to strengthen his position on this particular point. He used small figures and chains or arcs of triangulation for his statistical comparison, but I believe that if he applied the same techniques to broad extensive area networks he would look with more favor on the direction adjustments. In his own description of a station adjustment (with numerical examples) he does not include the condition that the adjusted angles should sum to 360°. This may not be too important since the same condition can be and in some cases must be introduced in the later net adjustment, but I think the average user of lists of angles derived from a station adjustment would prefer to have a consistent set of data. It would have been well for him to include an example of station adjustment for directions. This problem can be far more complex than indicated in his text.

The author deals quite extensively with the method of adjusting by variation of coordinates but indicates it might be better to compute on a plane than on an ellipsoid. Experience gained in both ways in the work of the Coast and Geodetic Survey would indicate that computing on the ellipsoid has greater over-all advantages. Also when area nets are adjusted it is better not to eliminate the station correction by Schreiber's method. When these unknowns are eliminated first in an area net, the density of the matrix is increased to a point where more multiplications are actually required even though the order of the matrix is considerably less. The higher order matrix has a much higher percentage of zero coefficients.

In his own writing, Mr. Rainsford has referred to many other texts. He has also included an up to date bibliography in the appendix for additional help to the reader. This very broad approach to a specialized subject makes this book an excellent reference volume for anyone who has an interest in the adjustment of survey data.

CHARLES A. WHITTEN

THE CALIFORNIA COUNCIL OF CIVIL ENGINEERS & LAND SURVEYORS—EIGHTH ANNUAL CONVENTION (Proceedings). Paper covered, 8½ × 11, lithographed, illustrated, 128 pages.

The proceedings of the Eighth Annual Convention of the California Council of Civil Engineers & Land Surveyors are divided into five sections, and contain the following:

Section 1—"California Water Development Program," by John R. Teerink; and "Water Rights and the Engineer," by Martin McDonough.

Section 2—"Engineer's Liability," by Robert O. Wilhelm; "Tax Trouble in Engineering and Surveying," by Wayne Hea; and "Engineering Registration in British Columbia," by J. A. Merchant.

Section 3—"Fees and Charges," (Panel)

Charles T. Blair, Moderator, Royal M. Sorensen, Jack R. Newville, William W. Moore, and Gordon R. Forrest; and "Improvement Acts and their Use in Financing Subdivisions," by Edgar A. Boyles, Jr., and David Hartley.

Section 4—"Labor Laws and Regulations," by Milton E. Jeanney; "Condemnation Without Compensation," by Hugh A. Evans; and "Surveyor Education and Licensing," (Panel) Walter J. Hanna, Jr., Moderator, William Lorrell, F. William Pafford, Francis H. Moffitt, and Oliver E. Deatsch.

Section 5—Administrative and Social Activities.

BOOK NOTES

In this section of the "Books in Review" department, we propose to include brief notices of books and other publications, which are not complete enough to be considered as reviews but which are in greater detail than is usually given concerning publications listed in the "Books and Pamphlets" section of the "Surveying and Mapping Literature" department. —EDITOR

CALIBRATION OF LINE STANDARDS OF LENGTH AND MEASURING TAPES AT THE NATIONAL BUREAU OF STANDARDS, By L. V. Judson, NBS Monograph 15, May 20, 1960, 12 pages. This monograph replaces NBS Circulars 332, 328, and 572.

The Bureau receives many requests from science, industry, and government to callibrate line standards of length and measuring tapes. This monograph is issued as a guide for anyone contemplating the submission of such items to the Bureau for standardization, and includes an outline of the calibration methods used at the NBS. The equipment used is described briefly. There is a discussion of some considerations that should be given as to whether or not a standard should be submitted to the Bureau for calibration, and instructions are given on how to submit such standards. The appendix contains useful information on the use of steel tapes.

Available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 15 cents per copy.

FOREST, WILDLIFE, AND RECREATIONAL RESOURCES—ATLAS OF ILLINOIS RESOURCES, SECTION 3. vi + 46 pages + fold out map, 9 × 12, heavy paper cover, plastic bound, many colored maps.

This publication, issued by the Division of Industrial Planning and Development, Department of Registration and Education, State of Illinois, contains a wealth of information on the forest, fur, fish, and game resources of the State of Illinois. There are included, in addition, a bibliography of publications relating to these subjects and an index of counties, cities, and towns in the State.

PLANE COORDINATE INTERSECTION TABLES (2½-MINUTE)—OREGON. Coast and Geodetic Survey, Publication 65–1, Part 35, 8 × 10, paper cover, iv + 166 pages. Available from Superintendent of Documents, Government Printing Office, Washington 25, D. C., at $1.00 per copy.

The tables in this publication contain the plane coordinates for 2½-minute intersections of meridians and parallels within the limits of the State of Oregon. These plane coordinates are based on the State plane-coordinate system established by the U. S. Coast and Geodetic Survey. The tables are arranged by 12½-minute bands of latitude with the full range of longitude of the Zone, followed by the coordinates for the next higher band of latitudes. The tables are also arranged by Zone.

These tables have been prepared for use in making maps. Meridians and parallels may be placed on maps constructed on a rectangular grid of the State system, or the grid lines of the system may be placed on maps constructed on a projection of meridians and parallels. In the latter case the grid will not be truly rectangular unless the projection has been constructed on the State system. Approximate values of plane coordinates of geographic positions may be obtained by interpolation within the tables. In general, this is not recommended, as it is believed to involve more numerical operations than a rigorous computation from the basic projection tables.

The basic projection tables for this State system may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

SURFACE WATER TEMPERATURE AND SALINITY, ATLANTIC COAST, NORTH AND SOUTH AMERICA. Coast and Geodetic Survey Publication 31-1 (First Edition). Paper cover, 7 × 10, 80 pages. Available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at fifty cents per copy.

The summaries of sea water temperatures and salinities presented in this publication are based on observations made in Atlantic harbor and coastal waters through the year 1958. The sea water temperatures and salinities were observed primarily at tide stations which, in the United States, were maintained by the Coast and Geodetic Survey, often with the cooperation of other organizations. Final results for places in Venezuela were furnished by the Ministerio de Obras Publicas, Estados Unidos de Venezuela. For places in other countries, the Coast and Geodetic Survey derived the data from observations made by organizations in the particular country. In Latin America, the observations were obtained through the cooperation of the Inter American Geodetic Survey.

USE OF NEAR-EARTH SATELLITE ORBITS FOR GEODETIC INFORMATION, by Paul D. Thomas. Coast and Geodetic Survey Technical Bulletin No. 11, January 1960. Paper cover, 8 × 10, 36 pages, illustrated. Available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 45 cents per copy.

This publication, heavily illustrated with maps, diagrams, and reproductions of photographs, sets forth a very considerable amount of information on the types of satellites needed and the facilities needed for tracking them. The Appendix, which makes up a little over half of the book, contains an imposing array of mathematical formulas involved in the launching and observation of such satellites and the reduction of the observed results. The book winds up with a 29-item bibliography which should prove very useful to anyone interested in pursuing this complicated business even further.

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Fairchild Completes Libyan Project

Fairchild Aerial Surveys, Inc., has announced the completion of aerial photography covering approximately 260,000 square miles of barren featureless wasteland in southern Libya. The project was undertaken on a non-exclusive basis for nine United States and foreign oil companies engaged actively in exploration of the area. Difficulties encountered included, in addition to quite inadequate and unreliable base maps, 130° temperatures, violent dust storms, and World War II land mines, one of which exploded, destroying a supply truck and seriously injuring the truck driver. Flights were made at altitudes between 23,000 and 25,000 feet, and two specially mounted cameras were triggered simultaneously to provide dihedral coverage of an angle of 134°. The dual oblique photographs were then transformed to equivalent vertical photography at a base laboratory. Average progress was about 3,000 square miles per day.

Time Signals

The United Kingdom and the United States have begun coordination of their Time and Frequency transmissions.

Coordination was begun early this year in order to help provide a uniform system of time and frequency transmissions, which is needed in the solution of many scientific and technical problems in such fields as radio communications, geodesy, and the tracking of artificial satellites.

Participating in the project are the Royal Greenwich Observatory, the National Physical Laboratory, and the Post Office Engineering Department in the United Kingdom, and, in the United States, the U. S. Naval Observatory, the Naval Research Laboratory, and the National Bureau of Standards. This program follows previous cooperative efforts of these agencies to achieve uniformity and simplification in procedures.

The transmitting stations which are included in the coordination plan are GBR and MSF at Rugby, England; NBA, Canal Zone; WWV, Beltsville, Maryland; and WWVH, Hawaii.

Coordination began in January. It is expected that by the end of 1960 the time signals from all participating stations will be emitted in synchronism to the thousandth of a second. Such accuracy has been needed for some time in tracking artificial satellites on a world-wide basis.

Abstracts of Articles on Geodesy and Related Fields

The following excerpts from *Articles on Geodesy and Related Fields*, Vol. V, No. 2, April 1960, are selected for reprinting in SURVEYING AND MAPPING as being of possible interest to a considerable number of our readers. The selection has been somewhat arbitrary, and only those abstracts believed to be of quite general interest have been included. —EDITOR

640 *A Contribution to the Theory of Errors in Traverse Lines Being Connected at Both Ends* (Ein Beitrag zur Fehlertheorie der beiderseits angeschlossenen Polygonzuege). Karl Hubeny

A study is presented concerning the theory of errors of a traverse line with very obtuse angles and equal sides, being connected at both ends. All possible assumptions concerning the connections are given in a general form and approximate formulae are developed.

The positional error at a considered point P_i, in the direction of the traverse (longitudinal error at P_i), consists of the summation of all errors in the lengths s_1 to s_{i-1} and of the change in position which this point undergoes due to the distribution of the total longitudinal error after the computation of the traverse. The mean error of length $\pm m_s$ (application of the law of the propagation of errors) is introduced and the true longitudinal error at P_i is given

$$m_{li}^2 = m_s^2 \frac{(n-i) \quad (i-1)}{n-1}$$

The positional uncertainty perpendicularly to the direction of the traverse at P_i, i.e., the transversal error at this point, is first computed for a connection of coordinates and direction at one end of the traverse.

For the computation of the positional error at P_i, perpendicularly to the direction of the traverse—with coordinates at both end points—a study is made of three possible forms of direction connections:

1. Without, or only with one direction connection at one end of the traverse, and
2. Direction connections at both ends.

In conclusion, the derivation of approximate formulae is shown by assuming the traverse, still having very obtuse angles and equal sides, to be developed in a system of coordinates l, q, one of whose axes is parallel to the direction of the traverse, the other perpendicular to it. The usual traverse computation and distribution of coordinate discrepancies can be imagined to be carried out in such a way that the traverse is computed once from the starting point $A \equiv P_1$ to the considered point P_i, then from the end point $E \equiv P_n$ likewise to P_i; at P_i the discrepancies now occur in the directions l and q. The two pairs of coordinates l_{iA}, q_{iA} and l_{iE}, q_{iE}, for the position P_i are obtained by taking the mean value using the weights $(n-1)$ for the former and $(i-1)$ for the latter pair of coordinates. This procedure corresponds exactly to the usual one in which the discrepancies are distributed.

The degree of approximation of the approximate formulae is also discussed. The latter yield partly very good results, partly values too small by up to 15 percent.

OESTERREICHISCHE ZEITSCHRIFT FUER VERMESSUNGSWESEN (German) AMS-GL-B661.-7000, Vol. 47, No. 3 (1959)-mc

649 *A Very General Integral Equation for Gravimetry* (Sur une équation très générale de la gravimétrie). J. J. Levallois

It is shown that the definition of the geoid and the height are closely connected. Furthermore, the definition of one of them depends upon the computation of the other.

The only tangible physical reality is obtained by measuring g and geopotential elevations on the topographic surface.

The height for the computation of the variable H is defined as follows:

$$\int g dH = \gamma'_m H$$

the value obtained on the topographic surface and the disturbing potential ΔW is:

$$\Delta W = W - U = W_o - \int g dH - [U'_o - \gamma'_m(H) - \gamma_o N]$$

that is:

$$N = \frac{W}{\gamma_o} - \frac{W_o - U_o}{\gamma_o}$$

BULLETIN GÉODÉSIQUE (French) AMS-GL-B920.7000, New Series, No. 50 (1958)-ma

651 *Azimuth Determination According to F. N. Krasovskiy's Method* (Azimuthbestimmung nach dem Verfahren von F. N. Krassovski). W. Rueger

Attempts have been made, for a long time, to simplify the azimuth determination in traversing. The basic idea of Krasovskiy's method is to derive the azimuth of Polaris by determining the difference in azimuth between Polaris and an auxiliary star. The most suitable arrangement for the observations and their evaluation, by means of step-by-step approximation, are discussed. A numerical example is given.

The greatest advantage of Krasovskiy's method is that only the difference in time is determined between the observations of Polaris and the auxiliary star; this difference generally will not exceed two minutes. Here, any pocket watch with a second hand can be used and its time and rate need not be known.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 7, No. 6 (1959)-ms

654 *Accuracy of Triangulation, New Limits of Error, and Criteria of Accuracy* (Ueber Triangulierungsgenauigkeit, neue Fehlergrenzen, und Genauigkeitskriterien). C. Bernatzky

As a basis for 1:2,000 mapping, control points must be determined with an accuracy of 0.2 to 0.4 m. The observational accuracy must be higher. The admissible error in the determination of points, resulting from trigonometric observations, is estimated at:

$$M = \pm 0.2 \text{ to } 0.4 : 3 = \pm 0.07 \text{ to } 0.13 \text{ m.}$$

The above amount is a measure for the internal accuracy of the net of control points and is related to the prescribed limits of error for the individual orders of triangulation. The relationship between trigonometric observational accuracy and the field of control points is discussed on the basis of admissible mean error of directions and admissible triangle closures, so that these errors may be separated from those of coordinates of connected points.

In order to judge the accuracy of the distances between points in the various orders and the homogeneousness of the field of control points, the relative mean error of lengths and the relative error in the determination of a point are computed. It is shown that, from the purely observational viewpoint, there exists uniformity between the individual orders of triangulation without any differences in quality between the results. It was assumed, here, that the law of the neighborhood* was strictly observed in all derived orders.

Therefore, the idea suggests itself of abandoning the relationship between admissible mean error of directions and a certain order of points with a specified average distance between points. It is suggested, rather, to make the limits of error for the observation of directions dependent upon the actual distances between points only.

Following this idea, limits of error for observation of directions which depend on the distance between points are established and criteria for their adherence were derived.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 7, No. 9 (1959)-mc

655 *The Problem of Lateral Refraction* (Zum Problem der Seitenrefraktion). L. Steinich

Lateral refraction is explained as a consequence of changes in density of the air along the line of sight. Since changes in density are due essentially to temperature differences, the refraction can be presented as a function of ΔT. It is stressed that the areas of atmospheric density disturbances caused by the topography must be avoided or eliminated by the appropriate selection of the time of observation in establishing a net. Some possibilities of taking account of lateral refraction in actual work are discussed, such as Kukkamaki's computation of corrections and Kučera's method of topographic weights. The topographic weight is to reduce the observation weight in such a manner that a weight is introduced which will take into consideration the irregular phenomena of refraction. Some instances of such phenomena of refraction are given for angle observations in base nets.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 7, No. 8 (1959)-ms

656 *The Fourth Check Measurement at the 1912 Standard Bench Mark in 1956* (Die 4. Kontrollmessung am Normalhoehenpunkt von 1912 im Jahre 1956). H. Kretzschmar

A complete description of the Standard Bench Mark is given, followed by a report on the re-

* The law of the neighborhood in triangulation lays down the principle of "passing from the large to the small," e.g., from a higher order to a lower order net, so that the homogeneousness of the entire triangulation is preserved.

covery of the entire complex consisting of the principal bench mark, the four reference points: East, East-East, West, West-West, and the additional six subsurface marks established in 1932 at the principal bench mark and the reference points East and West.

The purpose of the check measurement was to determine whether the elevation of the Standard Bench Mark had changed with regard to its immediate vicinity to a larger area (along the leveling line between Herzfelde and Hoppegarten) and whether any of the monuments had tilted.

The check measurement was carried out in three phases:

1. Determination of the elevation differences between the Standard Bench Mark and the bench marks along a fairly long leveling line;

2. Determination of the elevation differences between the ten subsurface marks;

3. Determination of the elevation differences between the principal bench mark and the four reference points.

After a detailed discussion of the measurements and the results obtained—only one subsurface mark (reference point West) showed a change in elevation of 2.5 mm—the author comes to the conclusion that the entire complex of the Standard Bench Mark has proved to be as permanent in position as it had been expected to be when established.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 7, No. 8 (1959)-ms

657 *Precise Leveling of River Crossings Used in the Resurvey and Extension of the Hiddensee Leveling of 1937* (Die feinnivellitischen Stromuebergangsmessungen bei der Wiederholung und Erweiterung des Hiddenseenivellements von 1937). F. Stopp

Two methods are described to show how it is possible to span rather wide areas of water with an accuracy of second-order leveling with the help of quite complicated targets.

In addition to a theoretical introduction into both methods, a discussion follows of the practical execution, in all its phases, of such a unique undertaking as it presented itself in the resurvey of the connection of the island of Hiddensee in the Baltic of 1937.

Setting-up of instrument and rod frames in the water is discussed in great detail.

VERMESSUNGSTECHNIK (German) AMS-GL-B664.7350, Vol. 7, No. 9 (1959)-mc

660 *New Theodolite Shown at the Budapest Industrial Fair.* (Új teodolit a Budapesti Ipari Vásáron).

Among the new geodetic instruments of MOM (Hungarian Optical Works) shown at the Budapest Industrial Fair, the newest Te-B1 Type second-theodolite, designed by Károly Bors, the Kossuth-award winner and Planning Engineer of the MOM, was of greatest interest.

With this theodolite, direct reading can be made of angle values of one second (estimates can be made to one-tenth of a second).

In the family of theodolites, the second-theodolite requires the highest adaptation of quality from the point of view of science and production technique alike. In designing the theodolite Károly Bors filed a number of patents which guarantee the precision of the instrument and the ease and speed of its operation.

The telescope of the instrument magnifies 30 times; the diameter of the objective is 45 mm. The same optical micrometer adjoining the telescope, is used for the readings of both the horizontal and verticle circles.

The MOM Te-B1 Type second-theodolite can be used for many purposes: second-order triangulation, precise traversing, as well as for underground engineering surveys and also for astronomical observations. Various attachments add to the wide-range usability of the instrument.

The mass production of the new instrument will begin in 1960, based on orders from foreign countries.

MÜSZAKI ÉLET (Hungarian) AMS-T4 M 21, Vol. XIV, No. 10, (1959)-af

662 *Completion of the Gravimetric Survey of Northwest Italy* (Completamento del rilievo gravimetrico nell' Italia Nord Occidentale). Giuseppe Inghilleri

The Italian Geodetic Commission requires a density of one station per 100 sq. km. for its gravimetric map. A survey was carried out, therefore, in 1956–57 to obtain this density. This survey, which covers a total of 276 new stations, was based on the net established by Eng. Cunietti in 1949–51 (248 stations) and also used 39 stations of the net established by the AGIP Mineraria. The station density is greatest in the areas of greatest gravity disturbances, such as a strip along the foot of the Western Alps and around Ivrea.

The elevations were taken mostly from the 1:25,000 maps; wherever possible, trig points, bench marks, and stations with known elevations along railroads were used. Closures never ex-

ceeded 0.35 mgal and the mean error for a station did not exceed 0.15 mgal.

Observations were made using the large as well as the small dial of the Worden No. 53 gravimeter. During the 1956–57 survey, the gravimeters were calibrated on the Bologna-Ferrara check base. Since this base did not exist at the time of Cunietti's survey, corrections are given to adapt Cunietti's data to the later measurements.

Some test connections of Cunietti's stations to the Italian Fundamental Net were made; the results were satisfactory.

The gravity reference for all stations is: Milan (gravimetric chamber) 980.5640 gal.

There were also established two stations at the French border with a view to connecting the Italian and French nets; one station at Ventimiglia and one at Monginevro (Clavière). The gravity differences for these stations with regard to Milan are given.

Including Cunietti's net of 248 stations and the 39 AGIP Mineraria stations, there now exist 563 gravimetric stations in Northwest Italy. Lists of stations and diagrams complete this paper.

Bollettino di Geodesia e Scienze Affini (Italian) AMS-CL-B641.2200, Vol. XVIII, No. 3 (1959)-ms

663 *Gravimetric Connections along the European Calibration Line and between the Control Stations of Intercontinental Connections Carried Out with Small Range Gravimeters* (Collegamenti gravimetrici sulla linea di taratura europea e fra le stazioni di appoggio ai collegamenti intercontinentali con gravimetri a piccolo campo). C. Gantar and C. Morelli

From 1952 to 1958, a series of gravimetric meridional connections was carried out from Kopenhagen to Bad Harzburg, on Mt. Etna, and as far as Tripoli as a contribution to the European Gravimetric Net. Suitable stations for international or intercontinental connections were utilized in order to compare the new absolute gravity measurements and to close or strengthen the First-order World Net. Worden gravimeters with small dials were used.

The Experimental Geophysical Observatory of Trieste participated in these operations. The measurements were reduced to a unique standard which, in addition to the reference calibration, includes the methods of reduction of the measurements to the same temperature and the same time.

Final results of the gravity differences in the "Italian conventional mgal" are presented in Table 19.

From the relative gravity measurements, it was found that the "Italian conventional mgal" is in satisfactory agreement with a future European or World mgal which will eventually be established along the European Calibration Line.

A comparison between the present measurements of the Experimental Geophysical Observatory and the original ones of the Italian Fundamental Gravimetric Net is also presented.

Bollettino di Geofisica Teorica ed Applicata (Italian) AMS-GL-B641.5500, Vol. I, No. 2 (1959)-mc

664 *Direct Comparison between the Italian and French Gravimetric Calibration (Conventional) Base Line* (Confronto diretto fra le basi gravimetriche di taratura (convenzionale) italiana e francese). C. Gantar

The French National Gravimetric Base Line between Paris and Toulouse, extended to Bagnères de Bigorre, defines the calibration of the gravimeters used in numerous connecting lines in Europe, Asia, Africa, and Oceania. In order to insert these gravimetric lines into the European Fundamental Net and the First-order World Net, it appeared necessary to carry out a comparison between the "French conventional mgal" and the "Italian conventional mgal," the latter being more easily relatable to the European calibration line and more securely comparable with a future European or World "mgal."

Observations were carried out with two Worden gravimeters, No. 50 an XPI, calibrated on the Italian National Gravimetric Base Line (Bologna-Ferrara), in July 1957, when the stations of the French Gravimetric Base Line from Paris to Toulouse and Bagnères de Bigorre were reoccupied.

Taking into account the temperature effect upon the scale factor of the gravimeters employed, the following final result was obtained:

"Italian conventional mgal" = "French conventional mgal" + 1.22‰.

Other indirect comparisons with the "French mgal" by pendulum and gravimetric observations are reported.

Bollettino di Geofisica Teorica ed Applicata (Italian) AMS-GL-B641.5500, Vol. I, No. 2 (1959)-mc

665 *On the Utilization of Radar Measurements of Long Meridional Arcs* (Sull'utilizzazione delle misure di lunghi archi di meridiano

con l'impiego del radar). Bartolomeo Bonifacino

The electronic measurements of long meridional arcs make an appreciable contribution to radar-geodesy. Two new groups of formulae are developed regarding the utilization of measurements of long meridional arcs. It is believed that the formulae presented may be utilized in radar-geodesy.

The radar-measured value is substituted for the length of the meridional arc. The corrections da and $d(e^2)$ which must be applied to the paramaters of the reference ellipsoid, assumed for the computation, are taken into account. Denoting by v_1 and v_2 the corrections which the values of the astronomic latitudes must undergo because of the inaccuracy due to the observational errors and because of the effect of the deflection of the vertical, we obtain for a generic arc s_k:

$$\text{a.}\quad a_k x + b_k y + l_k + v_{1k} = v_{2k}$$

$$\text{b.}\quad a'_k x + b'_k y + l'_k + v_{1k} = v_{2k}$$

and for several meridional arcs:

$$\text{a.}\quad \{a'_i, b'_i\}\begin{Bmatrix} x \\ y \end{Bmatrix} + \{l_i\} + \{v_{i\text{-}1}\} = \{v_i\}$$

$$\text{b.}\quad \{a'_i, b'_i\}\begin{Bmatrix} x \\ y \end{Bmatrix} + \{l'_i\} + \{v_{i\text{-}1}\} = \{v_i\}$$

which are solved by the least squares method.

Rivista del Catasto e dei Servizi Tecnici Erariali (Italian) AMS-HD671 R 62, Vol. 14, No. 2 (1959)-mc

666 *Dynamic, Orthometric, and Geopotential Elevations* (Quote dinamiche, quote orthometriche e quote geopotenziali). G. Boaga

A study of comparison between orthometric, dynamic, and geopotential leveling is presented with an emphasis on the new theory of the utilization of geopotential elevations.

The geopotential elevation of a point P on the Earth's surface is defined by

$$C_p = \sum_0^P g m/i \cdot \Delta Z_i$$

while the difference of the geopotential elevations between two points P_1 and P_2 on the Earth's surface is determined by

$$\Delta C = C_{p2} - C_{p1} = \sum_{p1}^{p2} i g m/i \cdot \Delta Z_i$$

and

$$C_{p2} - C_{p1} = \sum_1^n (g m_i - \gamma_o/45°)\Delta Z_i + \gamma_o/45° \sum_1^n i \Delta Z_i$$

where the last summation on the right-hand side represents the result originating from leveling in the field from P_1 to P_2, which is variable with the change in the course chosen to go from P_1 to P_2. The first term on the right-hand side here means the geopotential correction.

The following formula

$$\frac{C_{p2} - C_{p1}}{\gamma_o/45°} = \sum_1^n \Delta Z_i + \frac{1}{\gamma_o/45°} \sum_1^n (g m/i - \gamma_o/45°)\Delta Z_i$$

determines the difference of the dynamic elevations between P_1 and P_2; and if P_1 is on the geoid ($C_p = 0$), it yields the dynamic elevation of point P_2. The remaining term of the above equation is called the dynamic correction.

Taking into account that

$$\bar{g}_p = g_p + (0.1543 - 0.02092 \cdot \delta) \cdot Z$$

$H_p = C_p \div g_p$ determines the orthometric elevation of point P, obtained by means of the geopotential elevation of the same point P. The geopotential elevation C_p of a point P, expressed in ($\mu\, g\, p$) [$1\, \mu\, g\, p = 1$kgalm] is always about 2 percent lower than the elevation expressed in meters referred to sea level.

For comparison, the results obtained for the fundamental leveling line No. 1 from Genova to Tortona (74.816 km.) are presented in Tables I to IV, utilizing the observed gravity values. The line, in 1942–43, was reobserved by the Italian Military Geographic Institute, with large Zeiss levels Type A, and the data were published in 1955. This line was chosen because it extends along a meridian between the latitudes 44° 24′ and 44° 53′, i.e., over approximately half a degree in latitude, which results in a variation of 44 mgal in gravity due to the variation in latitude. The elevations of the bench-marks gradually increase from zero to slightly more than 400 m., thus producing a variation in gravity due to altitude of about 85 mgal.

On one graph, the horizontal course of the above leveling line is reproduced; on a second graph, it is shown with regard to gravity how, on the same line, the Bouguer anomalies steadily increase reaching a maximum in Tortona (132 mgal).

On the basis of numerical comparisons, it was determined that the observed gravity values must be known in order to calculate the reductions of measurements in the field obtained by precise geometric leveling.

Metano Petrolio e Nuove Energie, Anno

XII, No. 9, 1958 (Italian) AMS-GL-910.1115-mc

672 *Light Flashes Applied to Determining Positions of Artificial Earth Satellites* (Ob ispol'zovanii svetovikh vspishek dlya opredeleniya polozheniya iskusstvenykh sputnikov Zemli). G. A. Leykin

The following are the most advantageous features in using light flashes for determining positions of Earth satellites and rockets; in comparison with continuous sources of illumination, flashes produce a considerable economy of energy; without flashes it is very difficult to determine and record at which moment the satellite reaches a point in the celestial sphere. Due to the individual or accidental errors during the visual observations, the error of one determination can exceed 0.5 second. The determination of the moment of passage by radio methods is fettered by the low accuracy in determining the satellite's position in the celestial sphere.

These difficulties can be avoided to a considerable extent if a device producing flashes of light at prefixed moments of time is installed on the satellite. Modern devices have an accuracy of 1–0.1 percent of interval. The most promising source of light is the pulse gas-discharging lamp, where the duration of the flash can be reduced to several ten-thousandths of a second.

During photographic observations, a special series of several flashes over each photographing instrument should be produced.

Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya (Russian) AMS-QE500 A31, No. 12 (1958)-ma

Survey of the Chesapeake Bay

A dual purpose survey of the Chesapeake Bay, begun early in July 1960, is expected to lessen the burden on Uncle Sam's pocketbook. The Coast and Geodetic Survey will undertake a 1,500-mile shoreline survey of this much travelled waterway in cooperation with the Department of Tidewater Fisheries, State of Maryland.

The project will provide 37 special shoreline maps for the Maryland agency to assist in their study and development of seafood resources—especially oyster cultivation. In addition, the Coast and Geodetic Survey will revise about 80 of its own large scale base maps of the Bay with the aerial photography and field data thus acquired. Both Maryland and the Federal Government will share the expense of this project, which is expected to cost about $120,000.

The photography will be accomplished in two distinct phases. Black and white film will be used for the revision of land details on the maps and infrared film employed to emphasize shoreline detail at a mean high stage of the tide.

San Joaquin Valley Surveyors' Conference

The surveyors of the San Joaquin Valley, California, and neighboring communities held their third annual conference at Fresno State College on April 15 and 16. Prof. Edward F. Kulhan of Fresno State served as general chairman for this outstanding affair, the only general California surveyors' conference to be held in 1960.

Six informative papers were presented at plenary sessions by an excellent group of speakers, the subjects comprising computer applications, care and use of optical-reading instruments, a control survey of a Naval air base, Geodimeter surveying, a terrain data translator, and, of particular interest, the role of the surveyor in court as a witness and as a defendant. The latter included a description of an extremely interesting mine boundary dispute case involving a member of the Northern California Section of ACSM.

The afternoon of the second day was devoted to a surveyor's clinic at which each surveyor could attend any two of the thirteen demonstrations and talks covering a broad spectrum of subjects of surveyor interest. Included were lecture-demonstrations on various surveying techniques, surveying computations, property descriptions, map reading, and modern reproduction methods.

The Northern and Southern California Sections of ACSM were well represented at the conference and provided many of the speakers and clinic specialists.

—Paul J. Dowling
Chairman, NCS–ACSM

Map Information

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published or became available for distribution by the U. S. Geological Survey between March 1 and May 31, 1960. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged, but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or without the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown—except those marked with the letter (P), which are planimetric); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, township and section lines are shown. The State rectangular coordinate and the UTM 1,000-meter grid systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C., (or Denver 15, Colorado, for maps of areas west of the Mississippi River).

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* Indicates 15-minute quadrangles; all others are 7½-minute quadrangles.
[1] Indicates a revised map.
[2] Indicates a series-converted map.
† Indicates availability in either a contour or a shaded-relief edition.
‡ Indicates preliminary black and white edition.

Alabama

CHILDERSBURG—Talladega
HALEYVILLE EAST—Winston
HARPERSVILLE—Shelby
LYNN—Winston

Alaska

CHARLEY RIVER A-1*
CHARLEY RIVER A-2*
CHARLEY RIVER A-4*
CHARLEY RIVER A-5*
CHARLEY RIVER A-6*
CHARLEY RIVER B-1*
CHARLEY RIVER B-5*
CHARLEY RIVER C-4*
CHARLEY RIVER C-5*
KETCHIKAN D-1*
TANANA B-2*
TANANA B-3*
TANANA B-4*
TANANA B-5*
TANANA B-6*
TANANA C-2*
TANANA C-5*
TANANA C-6*
TANANA D-1*
TANANA D-2*
TANANA D-4*
TANANA D-5*
TANANA D-6*
VALDEZ A-1*

Arizona

BIG LAKE*—Apache
GILA BUTTE*[2]—Pinal
JUMPUP CANYON*—Coconino
MONKEYS HEAD—Yuma
O'DONNELL CANYON[1]—Santa Cruz
PHOENIX*[2]—Maricopa

Arizona-Nevada

SPIRIT MTN NE—Mohave

Arkansas

ARKADELPHIA—Clark

CADDO VALLEY—Clark
UMPIRE*—Howard

California

ARCATA NORTH—Humboldt
BOUQUET RESERVOIR*[2]—Los Angeles
BRIONES VALLEY—Contra Costa
COW MOUNTAIN—Mendocino
CRYSTAL LAKE—Los Angeles
CUYAMA RANCH—Santa Barbara
ELLEDGE PEAK—Mendocino
FLOURNOY*[1]—Tehama
GUADALUPE—Santa Barbara
HAYWARD[1]—Alameda
HETCH HETCHY RESERVOIR*—Tuolumne
HOLLISTER*[2]—San Benito
LAKE ELEANOR*—Tuolumne
LANCASTER*[2]—Los Angeles
LAS TRAMPAS RIDGE—Contra Costa
LONE PINE*—Inyo
MARE ISLAND[1]—Solano
MOUNT WHITNEY*—Inyo
NEWARK[1]—Alameda
OAKLAND EAST[1]—Alameda
OAKLAND WEST[1]—Alameda
PASTORIA CREEK[1]—Kern
PICO CREEK—San Luis Obispo
PIEDRAS BLANCAS—San Luis Obispo
PITTSBURG*[2]—Contra Costa
POINT SAL—Santa Barbara
POINT SUR*[2]—Monterey
PURDYS GARDENS—Mendocino
REDLANDS*[2]—San Bernardino
SAN QUENTIN—Marin
SAN SIMEON—San Luis Obispo
SANTIAGO PEAK*—Orange
SEBASTOPOL*[2]—Sonoma
THOUSAND PALMS*—Riverside
TYEE CITY—Humboldt
VALYERMO—Los Angeles
WALNUT CREEK[1]—Contra Costa

California-Nevada

FALES HOT SPRINGS*—Mono

Colorado

GRAND LAKE—Grand
MONTEZUMA—Summit

Connecticut-New York

NEW LONDON[1]—New London

Florida

BAYHEAD—Bay
BRADWELL BAY—Wakulla
BUSHNELL—Sumter
CAPE ST. GEORGE—Franklin
INVERNESS*[2]—Citrus
JACKSON RIVER—Franklin
JUNIPER CREEK—Calhoun
KENNEDY CREEK—Liberty
LAGUNA BEACH—Bay
LAKE WIMICO—Gulf
McINTYRE—Franklin
NEW INLET—Franklin
ORANGE—Liberty
PICKETT BAY—Franklin
QUEENS BAY—Liberty
ST. JOSEPH POINT—Gulf
ST. JOSEPH SPIT—Gulf
ST. TERESA—Franklin
SANBORN—Wakulla
SEMINOLE HILLS—Bay
SOUTHPORT—Bay
SUMATRA—Liberty
TATES HELL SWAMP—Franklin
TELOGIA—Liberty
TENMILE SWAMP—Calhoun
THOUSAND YARD BAY—Liberty
WEST PASS—Franklin
WETAPPO CREEK—Gulf

Georgia

JACKS GAP—Towns

Hawaii

HAWI—Hawaii
KUKUIHAELE—Hawaii

Idaho

CALDWELL—Canyon
KING HILL*—Elmore
LEWISTON ORCHARDS NORTH—Nez Perce
NOTUS—Canyon
SWEETWATER—Nez Perce

Idaho-Washington

LEWISTON ORCHARDS SOUTH—Nez Perce

Illinois

EDWARDSVILLE*[2]—Madison
JOLIET*[2]—Will
NORRIS*[2]—Grundy
WILMINGTON*[2]—Will

Illinois-Indiana

MAUNIE—White
MOMENCE NE—Lake

Illinois-Kentucky

ROSICLARE—Hardin
SHAWNEETOWN—Gallatin
SHETLERVILLE—Hardin

Indiana

ADAMS—Decatur
BEDFORD EAST—Lawrence
BICKNELL[1]—Knox
BROWNSBURG[1]—Hendricks
HAMLET—Starke
KINGSFORD HEIGHTS—La Porte
LYDICK—St. Joseph
MAYS—Rush
MILROY—Rush
NEW SALEM—Rush
SEYMOUR—Jackson
TUNNELTON—Lawrence
VALLONIA—Jackson

Indiana-Kentucky

MOUNT VERNON—Posey

Indiana-Ohio

BUTLER EAST—De Kalb
WOODBURN SOUTH—Allen

Kansas

ALTOONA—Wilson
ARMA—Crawford
BIG BOW NE—Stanton
BIG BOW SW—Stanton
BUFFALO—Wilson
BURRTON—Harvey
CATO—Crawford
GREAT BEND NE—Barton
HICKOK—Grant
HICKOK NW—Grant
HIGHLAND—Doniphan
KIRKWOOD—Crawford
NEODESHA—Wilson
PITTSBURG—Crawford
SEDGWICK NE—Harvey
SYCAMORE—Montgomery
ULYSSES NE—Grant

Kansas-Missouri

WHITE CLOUD—Doniphan

Kentucky

BOWLING GREEN SOUTH[1]—Warren
COLETOWN[1]—Fayette
KAYJAY[1]—Knox

Kentucky-Illinois

CAVE IN ROCK*[2]—Hardin
GROVE CENTER[1]—Union

Kentucky-Tennessee

HERNDON[1]—Christian
JOHNSON HOLLOW[1]—Trigg

Louisiana

AMITE*—Tangipahoa
ELIZABETH[1]—Allen
GRANT[1]—Allen
PITKIN[1]—Vernon
RIGOLETS—Orleans
STEEP GULLY[1]—Rapids
YSCLOSKEY*[2]—St. Bernard

Louisiana-Texas

BON WIER*—Newton

Maine

BAR HARBOR*[1]—Hancock
BIDDEFORD*[2]—York
DANFORTH*[1]—Washington
GRAY*[1]—Cumberland
PORTLAND*[2]—Cumberland
SMALL POINT*[1]—Sagadahoc

Maryland

SPARROWS POINT—Baltimore

Massachusetts

BLUE HILLS[1]—Norfolk
MEDFIELD[1]—Norfolk
NORWOOD[1]—Norfolk
PROVINCETOWN[1]—Barnstable
WELLFLEET[1]—Barnstable

Massachusetts-Connecticut

SPRINGFIELD SOUTH[1]—Hampden
WEST SPRINGFIELD[1]—Hampden

Minnesota

RAYMOND—Kandiyohi
WILLMAR—Kandiyohi

Mississippi

ARTESIA*—Lowndes
GULFPORT NW—Harrison
VIDALIA—Harrison
WAVELAND—Hancock

Mississippi-Louisiana

GRAND ISLAND PASS—St. Bernard
KINGSTON*—Adams
ST. JOSEPH*—Tensas

Missouri

BAGNELL[1]—Miller
BARNUMTON[1]—Camden
BOLLINGER CREEK[1]—Camden
BOYLERS MILL[1]—Morgan
EDWARDS[1]—Benton
ELDON[1]—Miller
GRAVOIS MILLS[1]—Morgan
GREEN BAY TERRACE[1]—Camden
KNOBBY[1]—Benton
LAKENAN—Shelby
LAKE OZARK[1]—Camden
LAKEVIEW HEIGHTS[1]—Benton
LENTNER—Shelby
LINCOLN SE[1]—Benton
PROCTOR CREEK[1]—Benton
RENSSELAER CREEK—Ralls
ROCKY MOUNT[1]—Morgan
SHAWNEE BEND[1]—Benton
SHELBINA—Shelby
TORONTO[1]—Camden
WOODLAND—Monroe

Montana

AVON*—Powell
BADGER PEAK—Rosebud
BILLICK COULEE—Valley
BLACK SPRING—Big Horn
BLANCHARD RANCH—Valley
BULL CREEK LOOKOUT—Big Horn
BUSBY—Big Horn
CHALKY POINT—Rosebud
ENGSTROM RANCH—Valley
FISHER BUTTE—Rosebud
GARFIELD PEAK—Rosebud
HOLLOWWOOD CREEK—Rosebud
JIMTOWN—Rosebud
LAME DEER—Rosebud
LEWIS RESERVOIR—Valley
SAGE CREEK POINT—Garfield

SEVENTH POINT BUTTES—Valley
SKUNK COULEE—Valley
SPLIT ROCK LAKE—Teton

Nevada

BLUE BASIN—Elko
DOBY SUMMIT—Elko
HUNTER—Elko
HUNTSMAN RANCH—Elko
SWALES MOUNTAIN—Elko

New Hampshire

HILLSBORO*[1]—Hillsborough

New Hampshire-Vermont

BELLOWS FALLS*[1]—Windham
KEENE*[1]—Cheshire

New Jersey

CHATSWORTH[1]—Burlington

New York

BLACK RIVER—Jefferson
BROWNVILLE—Jefferson
CAPE VINCENT SOUTH—Jefferson
CARTHAGE—Jefferson
CASTELE CREEK—Broome
CHAUMONT—Jefferson
CHENANGO FORKS—Broome
CINCINNATUS—Cortland
CLAVERACK—Columbia
CLAYTON—Jefferson
COPENHAGEN—Lewis
CROTON FALLS—Westchester
CUYLER—Cortland
ELLISBURG—Jefferson
ENDICOTT*[2]—Broome
ERIEVILLE—Madison
GENOA—Cayuga
HAMILTON—Madison
HIGH MARKET—Lewis
KEUKA PARK—Yates
LA FARGEVILLE—Jefferson
LODI—Seneca
MILLBROOK—Dutchess
MORRISVILLE—Madison
MUNNSVILLE—Madison
NEW BOSTON—Lewis
NORTH CREEK*—Warren
OVID—Seneca
PAGE—Lewis
PENN YAN—Yates
POINT PENINSULA—Jefferson
REDWOOD—Jefferson
SANDY CREEK—Oswego
SEARS POND—Lewis
SOUTH OTSELIC—Chenango
STONY POINT—Jefferson
TRUMANSBURG—Seneca
VERBANK—Dutchess
WEST EATON—Madison
WEST LOWVILLE—Lewis

New York-Connecticut

PAWLING[1]—Dutchess

New York-Vermont

WHITEHALL*[2]—Washington

North Carolina

HAMLET[1]—Richmond
LAURINBURG[1]—Scotland
SOUTHERN PINES[1]—Moore
VANDER[1]—Cumberland

North Dakota

NORTH KILLDEER MOUNTAIN—Dunn

Ohio

BOWLING GREEN NORTH—Wood
CANTON EAST—Stark
DUNBRIDGE—Wood
JERRY CITY—Wood
LINDSEY—Sandusky
OAK HARBOR*[2]—Ottawa
VICKERY—Sandusky

Ohio-West Virginia

GALLIPOLIS—Gallia
KNOXVILLE—Jefferson

Oklahoma

GOLDEN*—McCurtain
LAWTON*[2]—Comanche

Oregon

COTTAGE GROVE*[1]—Lane
TOLEDO*[1]—Lincoln

Oregon-California

KLAMATH FALLS*—Klamath

Pennsylvania

CALEDONIA PARK—Franklin
FREDONIA—Mercer
GREENVILLE EAST—Mercer
GREENVILLE WEST—Mercer
HARMONSBURG—Crawford
McCLURE—Snyder
MIFFLINTOWN—Juniata
NEW CASTLE NORTH—Lawrence

South Carolina

BULL ISLAND—Charleston
CAPERS INLET—Charleston
KIAWAH ISLAND—Charleston

South Dakota

BELLE FOURCHE*—Butte

Tennessee

ADAIR—Madison
CHATTANOOGA†—Hamilton
HARTSVILLE—Trousdale
HILLSDALE—Macon
HUMBOLDT—Gibson
INDIAN MOUND[1]—Stewart

Texas

ADELL—Parker
ANNETA—Parker
BEAR CREEK—San Jacinto
BROCK—Parker
CALVARY—Wood
CHAPIN—Hood
COURTNEY—Grimes
DAM DRAW—Mitchell
DEAD INDIAN MOUNTAIN—Coke
GARNER—Parker
GIRARD—Kent
GORDON*—Palo Pinto
JAYTON—Kent
KIRBYVILLE*—Jasper
LIPAN*—Hood
McWHORTER MOUNTAIN—Sterling
MILLICAN—Brazos
MINERAL WELLS*—Palo Pinto
NEW BOSTON*[2]—Bowie
PALO PINTO*—Palo Pinto
PECAN CROSSING—Mitchell
PLUM GROVE—Liberty
POOLVILLE—Parker
RELIANCE—Brazos
SILVER—Coke
SPADE RANCH—Mitchell
SPURGER*—Tyler
TATUM*—Rusk
TIN TOP—Parker
WASHINGTON—Washington
WEATHERFORD NORTH—Parker
WEATHERFORD SOUTH—Parker
YANTIS—Wood

Utah

BEAVER*—Beaver
BLANDING*—San Juan
BRUSHY BASIN WASH*—San Juan
CEDAR BREAKS*—Iron
MILFORD—Beaver
MINERSVILLE*—Beaver
NEW HARMONY*—Washington
ORDERVILLE*—Kane

Utah-Colorado

EASTLAND*—San Juan

Vermont-New York

TICONDEROGA*[2]—Washington

Virginia

MULBERRY ISLAND[1]—Warwick
PAMPLIN CITY*—Appomattox
THOROFARE GAP—Fauquier

Washington

AENEAS*—Okanogan
ELLENSBURG*—Kittitas
ELLENSBURG NORTH—Kittitas
FORT SIMCOE—Yakima
HARRAH—Yakima
HARRAH SE—Yakima
JOYCE*[2]—Clallam
KLOOCHMAN ROCK*—Jefferson
LAKE CRESCENT*[2]—Clallam
LA PUSH*—Clallam
MEDICINE VALLEY—Yakima
MOSES LAKE*[2]—Grant
MOUNT OLYMPUS*—Jefferson
MOUNT TOM*—Jefferson
FORT ORCHARD*—Kitsap
SELAH—Yakima
SOUTH BEND—Pacific
TOPPENISH MTN—Yakima
TOPPENISH SW—Yakima
WAPATO—Yakima
WESTERN—Grays Harbor
WHITE SWAN—Yakima

West Virginia

ELMWOOD—Mason
FELLOWSVILLE—Preston
HURRICANE—Putnam
NESTORVILLE—Barbour
POCATALICO—Kanawha

West Virginia-Ohio

MOUNT ALTO—Jackson

Wisconsin

FRANKSVILLE—Racine
GREENDALE—Milwaukee
RACINE NORTH—Racine
SOUTH MILWAUKEE*[2]—Milwaukee
SOUTH MILWAUKEE—Milwaukee
THIENSVILLE—Ozaukee

Wyoming

ALVA*—Crook
BOARS TUSK*—Sweetwater
CIRCLE BAR LAKE—Fremont
DICKIE SPRINGS—Fremont
FREIGHTER GAP*—Sweetwater
HAY MEADOW RESERVOIR—Fremont
INYAN KARA MOUNTAIN*—Crook
PARTING OF THE WAYS*—Sweetwater
PARTING OF THE WAYS—Sweetwater
PIERCE RESERVOIR—Carbon
THE PINNACLES*—Sweetwater
TULE BUTTE—Sweetwater

Wyoming-South Dakota

BEULAH*—Crook
FOUR CORNERS*—Weston
NEWCASTLE*—Weston

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the United States and territories are being published and distributed. They

may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Alaska
BLACK RIVER†
FORT YUKON
UNALAKLEET

Colorado
LEADVILLE

Kentucky
WINCHESTER

Kentucky-Virginia-West Virginia
JENKINS

Tennessee-Kentucky-Missouri-Illinois
DYERSBURG

Texas
BEEVILLE
CORPUS CHRISTI

Wisconsin
MADISON

The following National Park Maps are now available:
ZION NATIONAL PARK (KOLOB SECTION).[1] (31 by 34 inches) 1 : 31,680 scale. $1.50.
ZION NATIONAL PARK (ZION CANYON SECTION).[1] (46 by 38½ inches) 1 : 31,680 scale. $1.50.

The following map replaces a 1930 map at the same scale:
ISLAND OF OAHU, HAWAII (1954) (37 by 48 inches). 1 : 62,500 scale. 75 cents.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Michigan, at $1.00 per copy. Payment is required in advance by P. O. money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

0.—Great Lakes. Great Lakes, Lake St. Clair, Lake Champlain and New York Canals, at 1 : 200,000 scale.

5.—Lake Huron, at 1 : 500,000 scale.

11.—St. Lawrence River. St. Regis, Quebec, to Croil Islands, New York, at 1 : 30,000 scale.

12.—St. Lawrence River. Croil Islands to Leishman Point, New York, at 1 : 30,000 scale.

13.—St. Lawrence River. Leishman Point to Ogdensburg, New York, at 1 : 30,000 scale.

41.—Detroit River. Three miles south of Detroit River Light to Windmill Point, Michigan, at 1 : 30,000 scale.

51.—Lake Huron. Head of St. Clair River to Pointe aux Barques, Michigan, and Port Albert, Ontario, at 1 : 120,000 scale. Insets: Harbor Beach, Michigan, at 1 : 10,000 scale, and Port Sanilac, Michigan, at 1 : 5,000 scale.

75.—Lake Michigan. Southern end of Lake Michigan from Waukegan, Illinois, to South Haven, Michigan, at 1 : 120,000 scale. Inset: Michigan City, Indiana, at 1 : 10,000 scale.

701.—Lake Michigan. Farnsworth Point, Michigan, to 15 miles southwest of Escanaba, Michigan, including Big Bay de Noc and Little Bay de Noc, at 1 : 80,000 scale. Inset: Manistique, Michigan, at 1 : 15,000 scale.

743.—Lake Michigan. Milwaukee Harbor, Wisconsin, at 1 : 10,000 scale.

751.—Chicago Lake Front, from Wilmette, Illinois, to Gary, Indiana, and Chicago Sanitary and Ship Canal to Lockport, Illinois, at 1 : 60,000 scale. Inset: Gary, Indiana, at 1 : 15,000 scale.

752.—Lake Michigan. Chicago Harbor, Illinois, at 1 : 15,000 scale.

758.—Lake Michigan. St. Joseph and Benton Harbor, Michigan, at 1 : 10,000 scale.

767.—Lake Michigan. Muskegon, Michigan, and Muskegon Lake, at 1 :15,000 scale.

180.—New York Canals. Champlain Canal, Erie Canal east of Lyons, New York, Oswego Canal, and the Cayuga and Seneca Canals, including a line drawing of the Erie Canal between Lyons and Tonawanda on the Niagara River. A 60-sheet loose leaf volume, at 1 : 21,120 scale. 11 by 16 inches. $2.25.

1960 Great Lakes Pilot including complete set of seven monthly supplements (May through November). $3.25.

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between March 1 and May 31, 1960. The class or purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Alabama—Huntsville Meridian
T. 14 S., R. 6 E. (2)—Survey of islands
Ts. 14 S., Rs. 5 & 6 E.—Survey of islands
Ts. 17 & 18 S., R. 3 E.—Survey of islands

Arizona—Gila and Salt River Meridian
T. 17 N., R. 6 E.—Dependent resurvey, part
T. 41 N., R. 9 E.—Page Townsite subdivisions

California—Mount Diablo Meridian
T. 20 N., R. 3½ E.—Survey of subdivisions
T. 23 N., R. 15 W.—Extension survey
T. 3 S., R. 20 E.—Dependent resurvey, part

California—San Bernardino Meridian
T. 4 N., R. 2 E.—Dependent resurvey
T. 3 N., R. 3 E.—Resurvey and extension survey
T. 3 N., R. 5 E.—Dependent resurvey
T. 1 N., R. 12 E.—Dependent resurvey
T. 7 N., R. 6 W.—Dependent resurvey
T. 8 N., R. 6 W.—Dependent resurvey
T. 1 S., R. 11 E.—Dependent resurvey
T. 1 S., R. 12 E.—Dependent resurvey

Florida—Tallahassee Meridian
T. 66 S., R. 28 E.—Survey of island

Idaho—Boise Meridian

T. 30 N., R. 4 E.—Dependent resurvey, part
T. 29 N., R. 8 E.—Subdivision of sections
T. 9 S., R. 23 E.—Supplemental surveys
T. 8 S., R. 23 E.—Supplemental surveys
T. 7 S., R. 24 E.—Supplemental surveys
T. 8 S., R. 24 E.—Supplemental surveys
T. 15 S., R. 32 E.—Dependent resurvey

Michigan—Michigan Meridian

T. 51 N., R. 5 W.—Resurvey and subdivisional survey

Minnesota—Fourth Principal Meridian

T. 64 N., R. 18 W.—Survey of islands
T. 65 N., R. 19 W.—Survey of islands

Minnesota—Fifth Principal Meridian

T. 145 N., R. 34 W.—Survey of islands
T. 125 N., R. 38 W.—Survey of islands
T. 129 N., R. 41 W.—Survey of islands

Montana—Principal Meridian

T. 26 N., R. 59 E.—Survey of accretions

Nebraska—Sixth Principal Meridian

T. 30 N., R. 9 W.—Dependent resurvey, part
T. 31 N., R. 9 W.—Dependent resurvey, part
T. 31 N., R. 10 W.—Dependent resurvey, part
T. 29 N., R. 11 W.—Dependent resurvey, part
T. 30 N., R. 11 W.—Dependent resurvey, all
T. 31 N., R. 11 W.—Dependent resurvey, all
T. 32 N., R. 11 W.—Dependent resurvey, part
T. 29 N., R. 12 W.—Dependent resurvey, part
T. 30 N., R. 12 W.—Dependent resurvey, all
T. 31 N., R. 12 W.—Dependent resurvey, part
T. 32 N., R. 12 W.—Dependent resurvey, part
T. 32 N., R. 15 W.—Dependent resurvey, part

Nevada—Mount Diablo Meridian

T. 44 N., R. 33 E.—Dependent resurvey, part
T. 45 N., R. 33 E.—Dependent resurvey, part
T. 46 N., R. 33 E.—Dependent resurvey, part
T. 44 N., R. 34 E.—Dependent resurvey, part
T. 45 N., R. 34 E.—Dependent resurvey, part
T. 19 N., R. 60 E.—Survey of subdivisions
T. 20 N., R. 60 E.—Survey of subdivisions

New Mexico—New Mexico Principal Meridian

T. 5 S., R. 10 W.—Dependent resurvey, exterior
T. 6 S., R. 11 W.—Dependent resurvey, subdivisions
T. 6 S., R. 12 W.—Dependent resurvey, subdivisions

North Dakota—Fifth Principal Meridian

T. 141 N., R. 63 W.—Dependent resurvey, part
T. 140 N., R. 64 W.—Dependent resurvey, part
T. 141 N., R. 64 W.—Dependent resurvey, part
T. 142 N., R. 64 W.—Dependent resurvey, part

Oregon—Willamette Meridian

T. 2 S., R. 7 E.—Dependent resurvey, part
T. 34 S., R. 7 E.—Survey of Lobert Cemetery
T. 12 S., R. 20 E.—Dependent resurvey, part
T. 27 S., R. 3 W.—Dependent resurvey, part
T. 34 S., R. 4 W.—Dependent resurvey, part
T. 16 S., R. 6 W.—Dependent resurvey, part
T. 26 S., R. 7 W.—Dependent resurvey, part
T. 21 S., R. 8 W.—Dependent resurvey, part
T. 20 S., R. 9 W.—Dependent resurvey, part
T. 28 S., R. 9 W.—Dependent resurvey, part
T. 28 S., R. 12 W.—Dependent resurvey, part

Utah—Salt Lake Meridian

T. 2 N., R. 22 E.—Subdivision of sections
T. 2 N., R. 22 E. (3)—Dutch John Townsite
T. 36 S., R. 13 E.—Skeleton survey
T. 37 S., R. 13 E.—Skeleton survey
T. 36 S., R. 14 E.—Skeleton survey
T. 37 S., R. 14 E.—Skeleton survey
T. 36 S., R. 15 E.—Skeleton survey
T. 36 S., R. 16 E.—Skeleton survey
T. 35 S., R. 18 E.—Skeleton survey
T. 36 S., R. 1 W.—Skeleton survey
T. 37 S., R. 1 W.—Skeleton survey

Washington—Willamette Meridian

T. 29 N., R. 23 E.—Resurvey and subdivisional survey
T. 7 N., R. 31 E.—Resurvey and subdivisional survey

Wisconsin—Fourth Principal Meridian

T. 37 N., R. 10 E.—Extension survey

Wyoming—Sixth Principal Meridian

T. 45 N., R. 60 W.—Dependent resurvey
T. 46 N., R. 60 W.—Dependent resurvey
T. 47 N., R. 60 W.—Dependent resurvey
T. 49 N., R. 75 W.—Dependent resurvey
T. 49 N., R. 76 W.—Dependent resurvey

County General Highway Maps

THE FOLLOWING county general highway maps were received by the U. S. Bureau of Public Roads, Washington, D. C., during the period March 1 to May 31, 1960. Copies of these maps are sent to the Washington office as part of the continuing cooperative Federal-State highway planning program, as they are completed or revised by the State highway departments.

Inquiries concerning prices and orders should be sent to the respective State highway departments and *not* to the U. S. Bureau of Public Roads.

Arkansas
INDEPENDENCE
LAWRENCE
SEVIER

Colorado
GRAND

Florida
DESOTO
DIXIE
HIGHLANDS
LAKE
SUWANNEE

Georgia
ATKINSON
CHARLTON
CHEROKEE
COLQUITT
CRISP
DOUGHERTY
DOUGLAS
EMANUEL
FRANKLIN
GREENE
HANCOCK
HOUSTON
JASPER
JEFFERSON
MADISON
TOWNS
TWIGGS
WARE
WASHINGTON
WILKINSON

Idaho
BANNOCK
CARIBOU
ONEIDA

Illinois
ALEXANDER
BOND
BUREAU
CALHOUN
CHAMPAIGN
CLARK
CLAY
COLES
CRAWFORD
CUMBERLAND
DEKALB
DEWITT
DOUGLAS
EDGAR
EDWARDS
EFFINGHAM
FRANKLIN
FULTON
GALLATIN
GREENE
HAMILTON
HANCOCK
HARDIN
HENDERSON
HENRY
IROQUOIS
JACKSON
JASPER
JERSEY
JO DAVIESS
JOHNSON
KANE
KNOX
LAWRENCE
LEE
LOGAN
MACON
MARION
MARSHALL
MASON
MASSAC
McDONOUGH
McHENRY
MENARD
MONROE
MORGAN
MOULTRIE
OGLE
PEORIA

PERRY
PIATT
PIKE
POPE
PULASKI
PUTNAM
RANDOLPH
RICHLAND
SALINE
SANGAMON
SCHUYLER
SCOTT
SHELBY
STARK
STEPHENSON
TAZEWELL
UNION
VERMILION
WABASH
WASHINGTON
WAYNE
WHITE
WILLIAMSON
WINNEBAGO

Indiana

BARTHOLOMEW
FAYETTE
LAWRENCE
WARRICK

Iowa

ADAIR
ALLAMAKEE
BENTON
BREMER
BUCHANAN
BUTLER
CARROLL
CHICKASAW
CLINTON
DALLAS
DICKINSON
DUBUQUE
EMMET
FLOYD
GUTHRIE
HANCOCK
HARRISON
HENRY
HOWARD
HUMBOLDT
JACKSON
LINN
LOUISA
LYON
MADISON
MARSHALL
MILLS
MITCHELL
MONTGOMERY
MUSCATINE
O'BRIEN
OSCEOLA
PALO ALTO
PLYMOUTH
POCAHONTAS
POLK
POTTAWATTAMIE
SAC
STORY
WAYNE
WEBSTER
WORTH

Kansas

BROWN
GRAY
LABETTE
LINN
NEMAHA
REPUBLIC
WOODSON

Kentucky

McCREARY
WAYNE

Louisiana

CALDWELL
CONCORDIA

Michigan

ALLEGAN
BARRY
EATON
INGHAM
IONIA
KENT

Minnesota

NOBLES
PIPESTONE

Mississippi

AMITE
GEORGE
HARRISON
JACKSON
PIKE
STONE
WALTHALL
WILKINSON

Missouri

ANDREW
BENTON
LINN
MERCER
MORGAN
SCOTT

New Jersey

MONMOUTH

New Mexico

CHAVES
GUADALUPE

North Carolina

BERTIE
CAMDEN
CARTERET
CHOWAN
CURRITUCK
DARE
GATES
HERTFORD
HYDE
JONES
MARTIN
NORTHAMPTON
PASQUOTANK
PERQUIMANS
TYRELL
WASHINGTON

North Dakota

GOLDEN VALLEY
MERCER
WARD

Tennessee

BEDFORD
COFFEE
LINCOLN
ROBERTSON
RUTHERFORD
TROUSDALE

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Comment and Discussion

The pages of SURVEYING AND MAPPING are open to free and temperate discussion of all matters pertaining to the interests of the CONGRESS. It is the purpose of this department to encourage comments on published material or the presentation of new ideas in an informal way. —EDITOR

SURVEYING INSTRUCTION

JOSEPH STEINBERG*—The article, "The Status of Education in Surveying," by Russell C. Brinker, which appears on pages 55–66, inc., of the March 1960 issue of SURVEYING AND MAPPING, interested me a great deal, particularly Table 3 on page 63 which lists programs accredited by E. C. P. D. However, I failed to find our college listed.

For your information, we have been accredited by E. C. P. D. and do teach Surveying, both in the day and evening curricula. We offer two courses—one, Elementary Surveying, and the other, Route Surveying.

We have, in my opinion, a most complete inventory of surveying equipment, with such instruments as 6 builders' transits and levels, 6 engineers' levels, 1 self-leveling level, 6 transits, and 6 theodolites, plus the usual rods, tapes, bobs, etc. We are very proud of our accomplishments in the surveying field and, realizing that the 4-year colleges are constantly dropping surveying from their curricula, we are making every effort to go into the teaching of surveying in a more effective way. It is our fond hope that we shall eventually establish a Summer Camp and, at present, are planning a 1-year Certificate Course solely in Surveying.

This is being written you so that either a correction can be made in a forthcoming issue of your magazine or this information can be passed on to people who are interested. Should additional information be needed or desired, please do not hesitate to contact me, as I will be happy to supply it.

* Head, Construction Technology Department, New York City Community College, 300 Pearl Street, Brooklyn 1, N. Y.

CARTOGRAPHERS OF ONTARIO, CANADA, ORGANIZE

J. A. HADDON*—The article "Random Lines on Map Drafting" by Mr. Asher[1] prompts me to report two happenings of interest to cartographers, which took place recently in Ontario, Canada.

The Province granted a charter to the Ontario Institute of Chartered Cartographers—a body with decided views on who and what are cartographers—and the provincial Civil Service Commission recognized cartography as a distinct profession.

The Institute, a copy of whose constitution I enclose, defines a cartographer as one who designs, constructs and compiles charts and maps at any scale; assembles, evaluates, selects, correlates and plots data therefor; *creates map originals* for printed reproduction; edits and reviews maps for accuracy and quality. You will note that this resembles the definition used in recent A.S.C.E. discussions on Status in Surveying and Mapping with slight amendment and one significant addition which is in italics.

The Institute holds that however academically qualified a person may be, however distinguished his background, no one may reasonably call himself a cartographer who cannot actually make maps. One does not expect to encounter a surgeon who has never used a scalpel, and it is unreasonable to have cartographers unfamiliar with pen or brush. It acknowledges that many of its members will not be presently occupied "creating map originals" —in plain language, draughting, scribing or engraving—but it is deeply concerned that many aspects of map design are being forgotten in the present trend to consider maps as mechanical reproduction problems solved by mass-production techniques. It fears the trend to speciali-

* Chief Cartographer, Ontario Department of Mines, 32 Brougham Cres., Weston, Ontario, Canada.

[1] *See* SURVEYING AND MAPPING, March 1960, Vol. XX, No. 1, pages 53 and 54.

zation before sound comprehensive background training has been acquired, therefore will encourage training establishments to teach all fundamental skills, and will only admit those who have this training. A condition of membership is ten years experience in work which agrees with its definition. There is a junior membership for trainees.

A minor point in the A.S.C.E. definition with which the Ontario Institute takes issue is the statement that cartographers deal only with small scale maps. Obviously they make all maps—at large scales, small scales, big and little, of the land, waters, and land beneath the waters. If cartographers do not deal with large scale maps—who does?

At about the same time that the Institute was being formed, the provincial Civil Service Commission classification staff who were studying provincial mapmaking establishments concluded that cartographers were a separate species. They withdrew them from draughting grades, where they had languished to their discomfort, and created a new classification series ranging from Junior Cartographer (trainee) upward. The series was designed to provide career cartographers with adequate salaries and proper tuition, with formal examinations to decide promotion in the lower grades. It no more relates to draughtsmen than to plumbers. Limited skill technicians will be accommodated in other classifications and there is no intention to recruit cartographers from these grades.

In my view both these steps will help the public and the profession. As Mr. Asher points out, the title "map draughtsman" covers too many degrees and varieties of skills to be anything but misleading. The title "cartographer" meanwhile, with its pleasant air of mystery and dignity and its availability to all and sundry, is singularly attractive to those who wish to acquire status without the tiresome formality of learning the job—in fact it is in danger of being usurped by them. The Directors of the Ontario Institute hope that employers, personnel officers, and the public will come to recognize a chartered cartographer as one who is soundly trained in all basic cartographic arts and not only can talk about the job but do it. They would be interested to hear of other bodies whose aims are similar to their own.

MANUFACTURERS—ATTENTION!

KENNETH A. MACFAYDEN*—I would like to use your excellent publication to appeal to the manufacturers of stable-dimension drafting films to make a ten-squares-to-the-inch non-disappearing grid for the use of surveyors. What I have in mind would be a master sheet 36″ or 42″ wide by any length, which could be run through a black-and-white print machine to give a work sheet for plotting coordinates.

I believe the print paper should be fairly stable, since it usually has been exposed to the temperature and humidity conditions of the office for a while, and a great deal of time could be saved in ruling lines for plotting.

* Civil Engineer and Land Surveyor, 51 Pill Hill Road, Bernardsville, N. J.

METRIC SYSTEM

PAUL VAN BUSKIRK*—The publication in your last issue of a *Chicago Daily Tribune* editorial on the metric problem is out of place. Since when do engineers quote newspaper editors about scientific problems?

The United States Congress pioneered in the conversion of the Spanish piece of eight into a decimal type dollar. Our first coinage appeared in 1794, while the French were trying to get started. The Congress never would have decided in favor of the decimal venture, but for the knowledge that the people were used to the chain of one hundred links, with rods as quarters. Our half dollar is never marked fifty cents, our quarter is a quarter and two-bits still survives as a colloquialism for the pieces of eight and the related value shilling.

Our Army pioneered the decimally divided circle and adopted it for military use. The Artillery Corps developed the mil circle, also metric based, and it displaced the metric circle for military use.

Our Col. Long pioneered the chain of one hundred feet on the Baltimore and Ohio Canal, and it has almost replaced the chain of one hundred links.

* Advance Planning Engineer, The Huron-Clinton Metropolitan Authority, 18508 Manor Avenue, Detroit 21, Michigan.

With such a pioneer background, one would expect the United States to pioneer the chain of 144 feet, unically divided.

It is time to update the dollar. It could be made much more flexible with a quarter of 36 units, with coins 1, 3, 6, and 12 parts, abolishing the cent, nickel, and dime.

The United States was founded by pioneers and owes its success to the pioneering spirit. That we should even consider trailing along after the metric mirage is repugnant to this descendant of a 1654 emigrant.

How can a circle of 400 parts be "scientific," when the circle has a basic radius division of six parts (60°) and a half radius division of twelve parts (30°)? The clock face is the natural breakdown and becomes "scientific" when given place value. Children learn to count and see fractions on its face. That explains the difficulty some children have with decimal form fractions. Their doting parents are responsible for the finger-counting babytalk.

The editorial referred to above says "there is no point in fighting the fact that man was born with ten fingers." But one of these digits shifted around to enable him to become "homo sapiens" and he could then use his thumb to count on his twelve phalanges to a dozen and his other thumb to record dozens. The same driving force that caused his thumb to shift is still trying to make him earn the "sapiens" appellation.

CRISSCROSS

STANLEY M. SHARTLE*—Curtis M. Brown's reiteration (SURVEYING AND MAPPING, June 1960, pages 227–28) of the so-called "crisscross" computation is very worthwhile, but it should be pointed out that there is no dearth of information on the subject. It appeared in J. B. Johnson's *The Theory and Practice of Surveying* (3rd ed., 1887), John Wiley & Sons, page 205 et seq.; W. J. Raymond's *A Text-Book of Plane Surveying* (1st ed., 1896), American Book Co., page 149 et seq.; David Clark's *Plane and Geodetic Surveying for Engineers* (4th ed., 1946), Constable & Co., Ltd., Vol. 1, page 287; and is rejected, as "lacking method" and for being confusing, in A. L. Higgin's *Higher Surveying* (1st ed., 1944), Macmillen & Co., Ltd., page 169. Furthermore, on June 19, 1951, the late Vernon D. George of Silver Spring, Maryland, delivered a paper before the annual meeting of the ACSM entitled "The Intersection Solution" in which he discussed the problem at length and proposed the use of a short-cut form which makes precalculation sketches unnecessary.

Many surveyors are still computing, inversely, the length and bearing of the "closing" line from latitudes and departures between the two points whose coordinates are known, and then solving for the omitted or unknown measurements. A more convenient method is described by Mr. Brown, though it requires the making of sketches or other precomputation constructions to facilitate proper insight. For more than 20 years I have derived the formulas without sketches by forming and solving two simultaneous equations identical with those given by Johnson. The algebraic solution is not difficult, and several of my colleagues have developed the method independently as I did.

* Registered Professional Engineer, 2437 Allison Avenue, Indianapolis 24, Indiana, Staff Engineer, Indiana Toll Road Commission.

ERNEST CHRISBACHER*—In reading over Mr. Brown's article on crisscross computation in the June issue, I was impressed by its similarity to the intersection method used by several surveyors in this area. Charles Kaeffer of Canger Engineering Associates, Fair Lawn, N.J., says that to the best of his knowledge the first practical application of the intersection method was employed by Machael A. Canger while with Frank Harley about thirty years ago.

The intersection computation is based on the solution of simultaneous point-slope equations. The point-slope equation can be expressed as $y - y_1 = m(x - x_1)$, where x,y and x_1,y_1 are the rectangular coordinates of any two points on a line, and m is the slope of the line. Intersection can be used to solve the lengths of two intersecting lines with known bearings by first computing the coordinates of the point of intersection and solving between coordinates to determine the lengths. It has the advantage of offering a check on the bearings when solving between coordinates.

In Figure 1:

Given: (1) The coordinates of two points, A and B, and (2) The bearings of two lines,

* 25 Summit Avenue, Hawthorne, N. J.

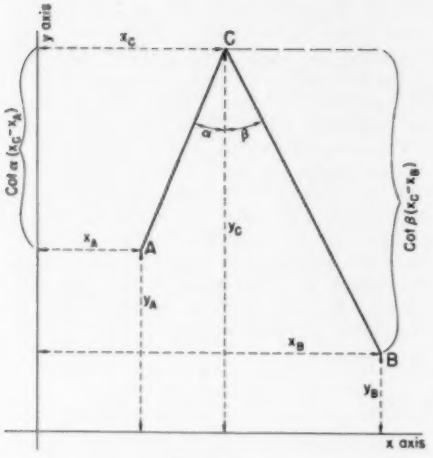


FIGURE 1.

AC and *BC*, originating at points *A* and *B* respectively.

Wanted: (1) The coordinates of point *C*, and (2) the lengths of lines *AC* and *BC*.

Solution: If α is the bearing angle for *AC*, and β is the bearing angle for *BC*, then the coordinates of point *C* may be computed by solving simultaneous point-slope equations. Cot α is used in place of *m* as the slope of line *AC* and cot β for the slope of the line *BC*.

$$y_c - y_a = \text{Cot } \alpha(x_c - x_a) \quad (1)$$
$$y_c - y_b = \text{Cot } \beta(x_c - x_b) \quad (2)$$

Since x_c and y_c are the only unknowns in equations (1) and (2), cancel out y_c by multiplying equation (1) by minus one; then add the two equations.

$$-y_c + y_a = -\text{Cot } \alpha(x_c) + \text{Cot } \alpha(x_a) \quad (1)$$
$$y_c - y_b = \text{Cot } \beta(x_c) - \text{Cot } \beta(x_b) \quad (2)$$

$$y_a - y_b = (\text{Cot } \beta - \text{Cot } \alpha)(x_c) + \text{Cot } \alpha(x_a) - \text{Cot } \beta(x_b)$$

Solving for x_c, the only unknown—

$$x_c = \frac{y_a - y_b - \text{Cot } \alpha(x_a) + \text{Cot } \beta(x_b)}{\text{Cot } \beta - \text{Cot } \alpha} \quad (3)$$

This equation is very convenient for calculating machine computation of x_c. Substituting the computed value of x_c in either of the original equations enables the value of y_c to be computed. When using equation (3) it is important to use the proper signs for the cotangent functions. Cotangents are always plus for NE and SW bearing angles and always minus for NW and SE bearing angles.

After the *x* and *y* coordinates of point *C* are computed, the lengths of lines *AC* and *BC* can be found by solving between the coordinates of points *A* and *C* and points *B* and *C*.

All possible combinations of intersecting lines may be computed by the use of this method; however, because of the limitations of natural-function tables, accuracy becomes limited as bearing angles approach zero.

Surveying Education in Iraq

From a study of a file of correspondence, which covers the period from March 21 to May 17, 1960, with exchanges of letters between Jacques J. O. Palgen, in charge of adadvanced surveying and photogrammetry, Institute of Surveying, University of Baghdad, in Iraq, and both Brother B. Austin Barry, Vice President, ACSM, and Professor Arthur J. McNair, School of Civil Engineering, Cornell University, in the United States, it develops that the University of Baghdad has already had in operation a two-year diploma course in surveying which has recently been expanded to the equivalent of a three-year course by the expedient of scheduling two years of rather theoretical training plus two, three-month, summer periods for field practice. The total of six months of full-time field work are judged to be equivalent to an additional year of work at the University.

Efforts are being made to further expand the curriculum and to eventually grant bachelor-of-science degrees in surveying and its allied fields.

Further, it develops that additional teachers are needed. Anyone well qualified to teach advanced surveying and who has an interest in a tour of duty at the University of Baghdad might well correspond with Jacques J. O. Palgen, 1047/7 Al-Mansur Estate, Baghdad, Iraq.

—EDITOR

News of Related Organizations

East Bay Council on Surveying and Mapping

Following nomination at the Fremont meeting, March 9, 1960, the following new officers will assume their responsibilities at the Oakland meeting, June 9, 1960:

General Chairman—James R. Godman
Vice Chairman—Albert A. Milano
Secretary—Alvin L. Wilson

Roy Akadegawa, chairman of the committee on "Report No. 22—Analytical Method of Adjustment of Control Stations," reported that he is obtaining much information via correspondence with a well-known former President of the ACSM, Carroll F. Merriam, formerly of the Baltimore, Maryland, area, but more lately of Prospect Harbor, Maine.

On the monumentation of the Alameda-Contra Costa County Common Boundary, EBCSM General Chairman Reuben Hurd reported that on March 8, 1960, the Alameda County Board of Supervisors had approved the project. EBCSM Secretary J. D. Kelly reported that the Contra Costa County surveyors, under the direction of Albert A. Milano, were presently working on the project. Retracement of the line in hilly areas is agreeing well with the topography, as the line follows natural ridges—but it is reported that, to date, none of the orginal monuments have been found.

Incoming Chairman James Godman reported that EBCSM Technical Reports No. 2 and No. 10 require no changes to comply with latest Coast and Geodetic Survey specifications for first- and second-order triangulation.

Chairman Hurd reported that the Waterfront Tidelands Development plans of the Alameda County Planning Commission, dealing with uses for reclaimed land, are of long-range scope and indicate possible future development that would be carried out by the various cities concerned. Mr. Hurd recommended that EBCSM deal with the appropriate cities when the time comes.

At the March meeting in Fremont, James F. Brewer, Senior Engineer, Alameda County Water District, spoke on the "Alameda County Water District Mapping Program." He first described the District, including its history.

The District was originally set up in 1914 as a Conservation District under the Water Conservation Act. Prior to 1930, its function was the protection of water rights and water conservation, including ground water. In 1930, the District became interested in selling water and began the development of its present metered system. It bought out the Alvarado Well System. The District now covers 100 square miles and includes Union, Fremont, and Newark. The City of Fremont extends beyond the limits of the District.

Four years ago the District had no maps of its plant. The City of Fremont was new and was in need of base maps. Mr. Brewer suggested that Fremont use the East Bay Council of Surveying and Mapping's Technical Reports as the basis for their mapping program. This they did, flying the area, exclusive of Newark, in a $40,000 mapping project.

The Water District obtains maps from the City (scale 1:2,400) and prepares its own maps from them—all in accordance with the recommendations in EBCSM Report No. 17, "A Base Map for the East Bay." A large, area map (scale 1:12,000) shows the entire system, including the grid, pipelines, hydrants, and reservoirs and wells, plus their capacities. Detailed maps (scale 1:1,200) show streets and rights-of-way; pipe type, size, and age; hydrant locations and types; E numbers, lot lines, account numbers, and street addresses. During the last two years, numerous old records, papers, and sketches, previously disorganized and therefore not usable, have been summarized, collated, and made available.

Mr. Brewer is well satisfied with the results of the District's mapping program and credits much of the success to the guidance received from the EBCSM's Technical Reports.

—J. D. KELLY
Secretary

Indiana Society of Professional Land Surveyors

The June 1960 issue of the *Surveying and Mapping Newsletter,* issued by the Indiana Society of Professional Land Surveyors—Division

of Adult Education, Purdue University, Lafayette, Indiana—Ken S. Curtis, Editor, contains, among other items, an excerpt from "Protraction—A New Technique for Cadastral Surveys in Alaska," by Donald B. Clement; a short article on "Temperature Corrections"; a "Report on ACSM Conference at Washington, D. C.," by C. B. Wood, president of ISPLS; and information as to how persons other than members of ISPLS may obtain copies of "Proceedings of Conferences on Land Surveying (1953–57)" and "Proceedings of Conferences on Land Surveying (1958–59)."

At the annual January business meeting of the Indiana Society of Professional Land Surveyors, the following officers were elected for the years 1960:

President—C. B. Wood, Angola,
President Elect—James Dankert, Indianapolis,
Vice President—Owen C. Smith, Fort Wayne,
Secretary-Treasurer—Nelson L. Prall, Bedford, and
Executive Secretary—Ken S. Curtis, West Lafayette.

Directors are (1960–61–62) George A. Crowder, Columbus, and Homer H. Gardner, Austin, (1960–61) Robert D. Fickle, Lafayette, and A. K. Hofer, Fort Wayne, and (1960) Arthur F. Buerkle, Lafayette, and Harrold E. Norris, Peru.

Ontario Institute of Chartered Cartographers

Word has been received of the organization of The Ontario Institute of Chartered Cartographers. The headquarters address of the Institute is 33 Norlong Blvd., Toronto, Ontario, Canada.

F. W. Love of Toronto is president, and H. S. Cox also of Toronto is secretary.

See "Cartographers of Ontario, Canada, Organize" in the "Comment and Discussion" department of this issue of SURVEYING AND MAPPING.

Corporation des Arpenteurs-Geometres de la Province de Quebec

The 77th Annual Meeting of the Corporation des Arpenteurs-Geometres de la Province de Quebec was held June 6–8, 1960, at the Manoir St-Castin, Lac Beauport, Quebec.

The American Congress on Surveying and Mapping was represented officially by Past President Lester C. Higbee. C. C. Lindsay, of the ACSM Advisory Council; Past Chairman A. Phillips Bill, of the Property Surveys Division, ACSM; and Winford Schofield, of New England's well-known family of land surveyors, a member of ACSM's Property Surveys Division, were in attendance at the meetings.

The Canadian Institute of Surveying's representation at the meetings included President Thistlewaite, S. G. Gamble, and H. D. G. Currie.

Many members of the Quebec association are also members of the Canadian Institute of Surveying and the American Congress on Surveying and Mapping.

Wisconsin Society of Land Surveyors

The following officers have been elected to serve the Wisconsin Society of Land Surveyors for the year 1960:

President—Roger Mueller, Oconto
Vice President—Foster Curtiss, Plymouth
Secretary-Treasurer—Robert L. Smith, Kenosha.

Georgia Association of Registered Land Surveyors

The Georgia Association of Registered Land Surveyors held its annual summer outing on Saturday, July 9, 1960, at the Ida Cason Callaway Gardens, Pine Mountain (formerly Chipley), Georgia, from 10:00 a.m., until ?. Each outfit brought its own lunch, but the soft drinks were on the GARLS. Swimming, boating, fishing, golf, sunning, miniature train rides, and good fellowship were there for all to enjoy. A very short business meeting was held, only for the purpose of installing new officers.

California Council of Civil Engineers and Land Surveyors

Executive Director William A. White of the California Council of Civil Engineers and Land Surveyors, in a letter addressed to the editor of SURVEYING AND MAPPING, states:

"Enclosed is a copy of the minutes of a Board

of Directors meeting of the California Council of Civil Engineers and Land Surveyors. You may be interested to note on page 3, the next to the last paragraph, that members of the Council will be asked to discontinue bidding on any kind of work in the engineering and surveying field after September 1, 1960. This will apply to photogrammetic work as well as all other kinds of engineering. It will even apply to the contracting of survey crews whenever the contractor has any responsibility for the product of the crews' work."

Two definitions in the minutes referred to above are of interest and are quoted below:

1. Competitive bidding is the procedure used when an engagement for professional engineering services is secured on a competitive price basis.

2. Examples of the practice that should come under the competitive bidding prohibition are services defined as civil engineering and surveying in Section 6731 of the Civil and Professional Engineers Act, and as defined also in the "Report on Surveying and Mapping" adopted by the American Society of Civil Engineers' Board of Direction in April 1959.

ACSM Announces a New Award—

The Keuffel & Esser Fellowship in Surveying

DEED OF AWARD

A. The name of the award is the Keuffel & Esser Fellowship in Surveying.

B. The purpose of the award is to encourage better students in Civil Engineering to do graduate work and specialize in surveying.

C. The award shall consist of a fellowship for one graduate student, amounting to $1,000.00 plus tuition for one year. The recipient of the award shall select the school where he will take graduate work in advanced fields of surveying.

D. The recipient of the award shall be selected by a "Keuffel & Esser Fellowship in Surveying" committee appointed by the President of the A.C.S.M.

RULES AND REGULATIONS FOR MAKING AND ADMINISTERING THE KEUFFEL & ESSER FELLOWSHIP IN SURVEYING

I The "Deed of Award" is incorporated by reference.

II The Keuffel & Esser Fellowship in Surveying Committee shall be appointed by the President of the ACSM to reflect objectively the educational, technical, scientific, and professional interests of ACSM.

The committee shall be comprised of not less than three or more than five appointed members. The Executive Secretary of ACSM will serve ex officio with the committee for reasons of continuity and official record.

Decisions of the committee shall be final.

III The award shall be made by May 15 for the next school year.

Applicants shall file in proper manner with ACSM Secretariat prior to January 1 of the awarding calendar year to be eligible for the award for the next school year.

Soon after January 1 of the awarding year, the committee (II above) shall strive to select the winner of the award from the eligible applicants prior to the annual convention of ACSM for pronouncement and presentation if feasible during the convention.

Applications shall reflect applicant's educational background, transcript records of scholastic ability, extra curricular activities, experience, supporting letters of recommendation and financial need of the applicant, and a photograph.

IV The tuition will be paid directly by Keuffel & Esser to the school. The $1,000.00 awarded will be paid in installments during the year as required by the student while enrolled in the school and successfully pursuing the course of study.

V Keuffel & Esser plans that the award shall be made on a year-to-year basis, subject to annual agreements of the officers of ACSM and Keuffel & Esser Co. The first award shall be made for the school year 1961–62.

Civil Engineering and Surveying Schools, and Surveying Instructors, are urged to make this award known to their students, and to cooperate accordingly in the filing of worthy applications.

Applications for the 1961–1962 school year must be filed before January 1, 1961. Mail applications to the Executive Secretary, American Congress on Surveying and Mapping, 430 Woodward Building, 733 15th Street, N.W., Washington 5, D. C.

—EDITOR

Congress News

ACSM Moves Central Office

The new address of ACSM Central Offices is Room 430 Woodward Building, 733 15th Street, N.W., Washington 5, D. C.

The new quarters are located adjacent to the offices of ACSM Executive Secretary, very convenient for frequent staff association and consolidation of ACSM administrative and operational activities. This was reason and purpose of the move which was approved by the ACSM Board of Direction at the 20th Annual Meeting following recommendation by the Building and Space Committee.

Arizona Section

The Seventh Arizona Land Surveyors' Conference was held April 9, 1960, at the University of Arizona at Tucson, under the auspices of the Arizona Section of the ACSM. Following registration and perusal of the very fine exhibits by Phoenix and Tucson instrument companies, the morning session was opened by James D. King, Chairman, Arizona Section, ACSM, who introduced several most provocative speakers. These included John S. Tsaguris, Associate Director, Tucson City-County Planning Dept., who discussed curvilinear subdivision planning; Philip B. Newlin, Associate Professor of Civil Engineering, with a graphic presentation of the State Coordinate System and its applicability to land surveying; and Roy E. Thurston, of the Topographic Division, U. S. Geological Survey, most appropriately reporting on the status of topographic surveying in Arizona.

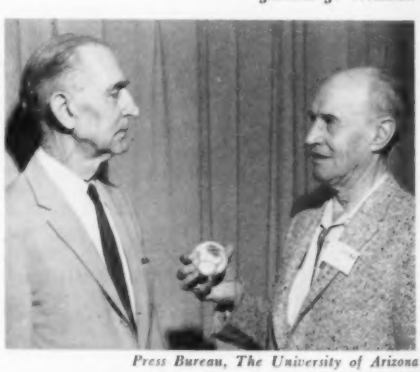
Luncheon followed, at which time prizes were presented by the equipment companies represented. John C. Park, Dean Emeritus of the College of Engineering, extended the exceptional honor of presentation of the University's 75th Anniversary Medallion of Merit to Harry F. Jones, pioneer Civil and Mining Engineer in Arizona.

Immediately following, an Executive Council meeting was held at which 19 new ACSM applications were reviewed and the applicants voted to membership. Clyde L. Armstrong was placed in charge of planning arrangements for the 1961 National ACSM Conference to be held in Phoenix.

The afternoon session was opened by Robert L. Frazer, Vice Chairman, Arizona Section, ACSM, introducing the honor speaker, well known title authority, land surveyor and engineer, and member of the ACSM Advisory Council, William C. Wattles, who quite adeptly presented many aspects of "Relocation—The Surveyors' Dilemma."

John H. Stufflebean, Tucson civil engineer, quite aptly prologued a panel discussion on "Ethics" which included a question and answer period for audience participation. A very successful conference ended with a field demonstration by the Geodimeter crew of the City of Phoenix.

—James J. Walden



Press Bureau, The University of Arizona

Dean Emeritus John C. Park of the University of Arizona College of Engineering presents the University's 75th Anniversary Medallion of Merit to Harry E. Jones, Phoenix land surveyor, at the Seventh Annual Arizona Land Surveyors' Conference at the University of Arizona on Saturday, April 9, 1960.

Editor's Note:—The Arizona Section, ACSM, has blossomed out with a modest bimonthly *Newsletter* under the editorship of James J. Walden, Route 6, Box 287, Tucson, Arizona. The first issue was concerned chiefly with reporting to the membership of the Arizona Section the events of the conference reported on by Mr. Walden in the above.

Northern California Section

The Bidwell Mansion on the campus of Chico State College in Chico was the location for the meeting of the Northern California Section on May 20, 1960. Thirty members of ACSM and Chico State engineering students attended.

Sponsored and arranged for locally by Prof. Jack Enfield of the Engineering Department of Chico State College, this was the first ACSM meeting to be held in Butte County.

Prior to the meeting session, those attending were entertained at a dinner at the Hotel Oaks in Chico through the courtesy of Harold W. Musser of the firm of St. Maurice, Helmkamp, and Musser of Marysville.

Herbert G. Passarino, of the civil engineering and surveying firm of Mobray and Passarino, Santa Rosa, spoke on "Preparation and Interpretation of Survey Descriptions." Mr. Passarino's talk covered description by section or other Bureau of Land Management subdivision, lot and block description in county-recorded subdivisions, and metes and bounds descriptions and their interpretation. He exhibited copies of several "vintage" maps which illustrated a typical lack of such important details as ties, bearings, and lengths. To demonstrate the progress that has been made in surveying and cartography, he then showed copies of several modern subdivision maps.

Door prizes, donated by Northern California firms, were won by Chico State engineering students Howard Moehrke and Michael O'Neill.

—Paul J. Dowling
Chairman, NCS–ACSM

Southern California Section

The following notes on the activities of the Southern California Section, ACSM, were furnished by Walter S. Dix, Executive Secretary, ACSM. —Editor

The Southern California Section, ACSM, now has a permanent address—Box 631, Main Office, Los Angeles 53, California.

Doyle Heape, Hank Rasnow, and Dan Whelan, who represented the Section at the Annual Convention in Washington, gave an interesting report on the record breaking meeting.

Bill Wattles reported on the Tucson meeting (Arizona Seventh Annual Land Surveyors Conference) and plans underway for the Arizona Section's sponsorship of the ACSM Western Regional Meeting at Phoenix in 1961.

Members from Los Angeles, Bakersfield, and other Southern California Section areas attending the Third Annual San Joaquin Valley Surveyors Conference, included Odis Johnson, Bill Wattles, and Bill Pafford, ably assisted by Ed Kulhan who put on another of his worthy endeavors. The proceeds from registrations and booths go for student scholarships.

Some forty-five attended the meeting of March 16, 1960, at Los Angeles Junior College to hear Floyd Glaser, Bill Pafford, and Selwyn Douglas give interesting talks.

The meeting of May 18, 1960, was held at Citrus College. George Psomas, Beverly Hills land surveyor, discussed "The Apprenticeship Program—Civil Engineers, Land Surveyors, and Operating Engineers Union." Gene Fitzwater of Pafford and Associates talked on "Photogrammetry," and John Odekirk of Standard Oil Company discussed "Some Aspects of Petroleum Cartography."

Colorado Section

An informal, joint, dinner meeting of the Colorado Sections of both the American Congress on Surveying and Mapping and the American Society of Photogrammetry was held May 3, 1960, at 7:00 p.m., in the Grill Room at the Leyden-Chiles Wicksersham Post No. 1, American Legion, Denver, Colorado. J. Loren Adams, Chairman, Colorado Section, ACSM, presided. In attendance were 49 members, wives, and guests.

After a delicious dinner, Mr. Adams welcomed the group in attendance and introduced James Romson, Public Relations, Jack Ammann Photogrammetric Engineers, who, in turn, introduced Orlo S. Childs, Director of Exploration Projects Group for Phillips Petroleum Company, and President of the Rocky Mountain Association of Geologists.

Mr. Childs gave a most interesting illustrated talk on the Grand Canyon of Arizona and Brice and Zion Canyons in Utah.

Two door prizes were offered, one going to Mrs. Childs and the other to Mrs. Mundine.

The festivitives concluded at 9:30 p.m.

—E. O. Windham
Secretary-Treasurer

Louisiana Section

The annual meeting of the Louisiana Section, ACSM, was held Tuesday evening, May 10, 1960, in the Engineers Club of the DeSoto Hotel, New Orleans, Louisiana.

A special guest and speaker of the evening was Walter S. Dix, Executive Secretary, ACSM. Mr. Dix was entertained by the retiring and incoming officers of the Louisiana Section at an informal dinner at Kolb's Restaurant in New Orleans prior to the business meeting.

Another special guest at the meeting was Mel Silverstein, first place winner in regional competition for his senior mathematics exhibit at the Ninth Regional Science Fair held at Tulane University. The fair was sponsored jointly by Tulane University and the Louisiana Petroleum Council. Mr. Silverstein, a senior student at Fortier High School in New Orleans, also placed third in Statewide competition with his exhibit. The Louisiana Section, ACSM, contributed $25.00 as a prize to first and second place award winners in the mathematics exhibits at the fair.

Left to right—Walter S. Dix, Executive Secretary, ACSM; Robert C. Dayton, Chairman, Louisiana Section, ACSM; Mel Silverstein, senior high school student and award winner for mathematics exhibit at Ninth Regional Science Fair; and C. E. Bridges, Past Chairman, Louisiana Section, ACSM.

It was decided during the business session to amend the Section's bylaws and make the annual dues payable January 1 instead of April 1 of each year.

Mr. Dix presented a very interesting and informative dissertation on the beginnings, progress, and aims of the American Congress on Surveying and Mapping. The 40 members of the Louisiana Section who were present were gratified to hear directly from one so well informed a realistic discussion of some of the problems confronting members of the ACSM and possible solutions to those problems.

Upon completion of Mr. Dix's talk, Chairman Dayton presented the Section's officers for the coming year and relinquished the chair to incoming Chairman F. C. Gandolfo. After a brief statement of appreciation, Chairman Gandolfo adjourned the meeting.

New officers for 1960 are:
Chairman—F. C. Gandolfo
First Vice Chairman—H. G. Sneed
Second Vice Chairman—J. F. Fontcuberta
Third Vice Chairman—H. G. Truelove
Secretary—G. F. Radley
Treasurer—R. S. Burnside, Jr.
Directors—(Two year terms) S. P. Chapman and C. H. Fenstermaker. (One year terms) C. R. Reed, W. J. LeCompte, and A. W. Laborde.

—R. S. Burnside, Jr.
Section Editor

NEW OFFICERS—LOUISIANA SECTION

Front row, left to right—R. S. Burnside, Jr., Treasurer; Walter S. Dix, Executive Secretary, ACSM; F. C. Gandolfo, Chairman; and G. F. Radley, Secretary. *Back row, left to right*—W. J. LeCompte, Director; H. G. Sneed, First Vice Chairman; S. P. Chapman, Director; C. H. Fenstermaker, Director; and A. W. Laborde, Director.

St. Louis Section

From the May 1960 issue of the *St. Louis Section Newsletter,* we learn that the April 5th meeting of the Section, attended by some 150 members and friends, was a dinner meeting. After an excellent Anheuser-Busch roast beef dinner, the group moved to the brewery's Hospitality Room, and, after brief announcements, Chairman Finnie introduced the speaker of the evening.

Colonel Robert E. Herndon, Jr., Commander, Aeronautical Chart and Information Center, repeated the illustrated lecture entitled "Aerospace Cartography" which he had presented on March 22, 1960, at the 20th Annual Meeting of the ACSM in Washington, D. C.

He described how products of the organization he commands assisted in guiding a 70-foot jet Air Force F-106 Delta Dart on an experimental flight from Palmdale, California, to Jacksonville, Florida, in 3 hours and 17 minutes

on March 23, 1960. In the case of the ACIC products used on this flight (film strips and punched computer tape), as well as for other products discussed later on, lantern slides provided pictorial support for Colonel Hernden's remarks.

Next, charts to be used by Astronauts and others involved in planning or participation in Project Mercury were shown and discussed.

This was followed by a resume of the ACIC's moon-charting activities. ACIC's endeavor in this field, are "Lunar Atlases," mosaic charts of the Moon, and coordinate and surface-height studies and calculations.

The final ACIC program covered was that of planning for the determination of three-dimensional coordinates of points in space.

The talk was extremely interesting to those in attendance, especially to those ACIC employees who were present, because, although some of them had been engaged in working on portions of one or another of the products described, very few employees knew of all four of these endeavors in which ACIC has been engaged.

An indication of the value that this talk was believed to have for ACIC employees became evident when Colonel Herndon, at the request of Chairman Finnie, repeated the talk twice before selected groups of ACIC employees a few days after its presentation to the St. Louis Section.

Personals

Charles W. Westrater, Assistant Chief, Department of Cartography, Army Map Service, Corps of Engineers, U. S. Army, retired on July 12, 1960, after thirty years of service. He plans to enjoy boating and fishing at his Cobb Island home near where the Potomac River joins Chesapeake Bay. He was honored by his close associates in cartography over the years with a luncheon on Tuesday, July 12, at the Army Map Service, and by his friends at a stag dinner at the Fort Meyer Officers Club the following evening.

Robert H. Randall, one of the organizers and first President of the American Congress on Surveying and Mapping, retired from the Federal service on July 11, 1960. He is now Vice President of the Aero Service Corporation of Philadelphia, Pennsylvania. His service in Government has included membership on the Committee of the National Academy of Sciences on Organization of Federal Government Surveying and Mapping; Consultant, National Resources Planning Board on State and regional planning, public works and urbanization; Consultant, Tennessee Valley Authority on surveys and maps; U. S. Member, Committee for Public Works Planning of the International Labor Organization; and Assistant on Cartography, U. S. Bureau of the Budget, Executive Office of the President.

During the period of his Federal service, he has held many important posts, including: President, Pan American Institute of Geography and History; U. S. Member and Chairman, United Nations Committee on Cartography; and Chairman of the U. S. Delegation to Pan American Institute of Geography and History meetings in various American Republics for eight terms from 1943 to 1958.

He received the decoration Cruzeiro do Sul from Brazil and the Order of Duarte from the Dominican Republic. In 1952 he was awarded the honorary degree of Doctor of Science from the University of Santo Domingo.

Mr. Randall expects to maintain residence in the Washington area but to spend part of his time in the Aero Service Corporation offices in Philadelphia.

R. D. Turpin moved, about September 1, 1960, from Taylor Hall 173, University of Texas, Austin 12, Texas, to Department of Civil Engineering, University of Wisconsin, Madison 6, Wisconsin.

Deaths

Ernst Ewoldsen, whose death on March 15, 1960, as a result of a heart attack, was noted briefly in SURVEYING AND MAPPING, June 1960, page 263, was an employee in the office of the Alameda County Surveyor and Road Commissioner. He was chief of the Lands Division and in chanrge of boundaries, surveys, maps, subdivisions, and rights-of-way. He was a native of Schleswig-Holstein, Germany, but had lived in California since 1927. He was a member of the East Bay Engineers' Club, the Alameda County Surveyors' Club, and the American Congress on Surveying and Mapping. He was a licensed land surveyor in California. He is survived by his wife, Ruth Ross Ewoldsen; two children, Karen and Ross Ewoldsen; a brother Hans Ewoldsen of Big Sur, California; and a brother and sister, Peter and Christine Esmark, of Schleswig-Holstein.

Ernest Steinbrenner, since 1945 a partner in Teas and Steinbrenner, Malverne, N. Y., died July 11, 1960. He was a member of the Nassau-Suffolk Civil Engineers, Inc., and the New York State Society of Professional Engineers, as well as the ACSM. He had also been a member of the Town Board of the Town of Hempstead since 1942.

Theodore L. Leach, St. Clair County Drain Commissioner, died Saturday, July 2, 1960, in Port Huron Hospital after a short illness.

Mr. Leach was born April 27, 1894, in Ionia County. He married Margaret Campbell June 24, 1924, in Port Huron.

He is survived by his widow; two daughters, Mrs. Mary Frances Cloetingh, Muskegon, and Mrs. Peggy Crull, Cincinnati; a sister, Mrs. Arthur Moody, Grandville, Michigan; four grandchildren and several nieces and nephews.

Rev. Merton L. Stevens, superintendent of the Methodist Churches of the Port Huron District, officiated at the funeral service on July 6, 1960, and interment was in Lakeside Cemetery under the auspices of Pine Grove Lodge No. 11.

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grant from the National Science Foundation as a cooperative venture, with twelve or more organizations participating. Scientific phases of the expedition were under the personal direction of Dr. Harris B. Stewart, Jr., Chief Oceanographer of the Survey. The U. S. Weather Bureau assigned a meteorologist to the expedition who conducted important studies of the upper atmosphere by means of balloons released at regular intervals.

The Census Bureau, had a non-oceanographic interest in the expedition. Arrangements were made for taking the 1960 census of the Swan Islands, probably this country's least known possession, while the *Explorer* was in the area.

The Fish and Wildlife Service and the U. S. Geological Survey were vitally interested in this expedition. A geological survey of the Swan Islands was undertaken; and, for the Fish and Wildlife Service, dredgings to recover bottom-dwelling animals were made in the Caribbean and in the Straits of Florida. Mammals, reptiles, and insects were collected on the Swan Islands for the U. S. National Museum. Attempts were made to capture live animals on these islands for the National Zoological Park.

Samples of ocean-bottom sediments to be tested for radioactivity were collected for the U. S. Public Health Service for use in its radio chemical surveillance program.

The U. S. Navy Electronics Laboratory at San Diego had on board a deep-sea camera for photographing the ocean bottom off the West Coast of Central America, where the Russian oceanographic ship *Vityaz* reported the bottom to be covered from 80 to 100 percent with nodules of manganese which were also high in nickel and cobalt.

Observations were made at eleven positions off the coast of Oregon, in cooperation with the Scripps Institution of Oceanography and Oregon State College. At each station water samples were obtained to study the distributions of salinity, dissolved oxygen, phosphate, and temperature. Also surface water samples were obtained, from which it is hoped that suspended sediment will help oceanographers learn what happens to Columbia River water once it enters the Pacific.

The Scripps Institution provided a magnetometer to be towed behind the *Explorer* from San Diego to Norfolk, to provide a continuous record of the earth's magnetic field along the ship's track.

Throughout the entire expedition current drift bottles were dropped at regular intervals. These have cards enclosed asking the finders to inform the Coast and Geodetic Survey where the bottles are recovered. It is hoped that these bottles will provide clues to the circulation of the waters along the Pacific Coast of North and Central America, and in the western Caribbean and the Gulf of Mexico, and also add to our knowledge of the Gulf Stream.

The ocean's temperature was taken at hourly intervals throughout the trip.

Oceanographic observations, similar to those off the Oregon coast, were made at regular intervals in the Pacific, the Caribbean, the Gulf of Mexico, and along the Atlantic Coast.

Of special interest will be measurements of the speed and direction of the Gulf Stream, not only at the surface but at depths down to about 1,500 feet.

The ocean bottom was under constant surveillance by means of electronic echo-sounding equipment aboard the *Explorer*. Divers from the Coast and Geodetic Survey explored the

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Florida	25	Maine	1	Ohio	5	Total	289
Georgia	1	Maryland	20	Oklahoma	1	Foreign	15
						Total	304

Surveying and Mapping Conference

The second Surveying and Mapping Conference, presented by the School of Civil Engineering and the Division of Engineering and Industrial Extension, Oklahoma State University, in cooperation with the Colorado Sections of the American Congress on Surveying and Mapping, the American Society of Photogrammetry, and the American Society of Civil Engineers, was held at Camp Benham, near Buena Vista, Colorado, June 20 and 21, 1960. The sponsoring staff included Prof. R. P. Witt, Prof. D. M. MacAlpine, and Prof. J. W. Comer of Oklahoma State University.

During the morning session, on Monday, June 20th, Prof. Witt welcomed those attending the Conference, and Captain William C. Russell, Coast and Geodetic Survey, spoke on "Engineering Uses of Geodetic Control."

The afternoon session comprised three papers, as follows:

"U. S. Public Land Survey," by John S. Knowles, Bureau of Land Management,

"What the Topographic Division of the Geological Survey has for the Private Engineer or Land Surveyor," by Emmett J. Coon, U. S. Geological Survey, and

"The Application of Geology to Civil Engineering Projects Using Air Photo Interpretation," by Curtis L. Amuedo, of Doeringsfield, Amuedo and Ivey, Consulting Geologists, Denver, Colorado.

Earle J. Fennell, U. S. Geological Survey, spoke at the dinner in the evening on the subject "Surveying and Mapping, a Basic Part of Civil Engineering."

Both sessions on Tuesday, June 21st, featured the Geodimeter. John C. Bass, Sales Manager, Geodimeter Division of AGA Corporation of America, spoke on "The Geodimeter" at the first session. At the second session he staged

(Continued on page 398.)

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Mapping and Surveying Short Course

The 20th Bi-Annual Mapping and Surveying Short Course, sponsored by the Georgia Association of Registered Land Surveyors and the school of Civil Engineering, and conducted by the Department of Short Courses and Conferences, Georgia Institute of Technology, will be held at Atlanta, Georgia, January 26–28, 1961.

As it has for almost forty years, this program will try to keep the surveyors of Georgia and the Southeast aware of new achievements in the field. The theme for the 1961 meeting will be "The Importance of Surveying, Mapping, and Photogrammetry in the Space Age."

All presentations will be keyed as much as possible to the new techniques available to the working surveyor and to the new equipment that has reached the market. Manufacturers will be invited to display their latest devices as an important adjunct to the program. A special display area will be set aside.

The 1961 program will be held in the Architecture Auditorium on the campus of the Georgia Institute of Technology. The displays will be in the exhibition area, which is directly above the auditorium.

For information on fees, housing, etc., write to: Director, Short Courses and Conferences, Georgia Institute of Technology, Atlanta 13, Georgia.

Coast Survey Reorganization

Secretary of Commerce Frederick H. Mueller announced on July 22, 1960, a reorganization of the U. S. Coast and Geodetic Survey which provides for major shifts in program direction and emphasis in the areas of scientific research and oceanography.

In making the announcement he said, "These changes streamline and strengthen the organizational structure of the Survey, the oldest scientific bureau in government. The reorganization is designed to meet the needs of the new, revolutionary age of science and technology and thereby to provide new knowledge and new services for use by the government and the public in promoting sound economic growth. The arrangement is one of the results of the Department's continuing, intensive study of and active attention to the science and technology functions in the Department of Commerce. In this connection, the report of a Special Advisory Committee of the National Academy of Sciences entitled 'The Role of the Department of Commerce in Science and Technology,' issued last Spring, proved particularly helpful in developing the Survey reorganization."

The substantative changes in the Survey structure are centered in two newly created offices: the Office of Research and Development, and the Office of Oceanography.

The Office of Research and Development will prosecute vigorously basic research in the earth science fields of the Survey's work, and coordinate and assist in applied research and development conducted by technical divisions in its field of competence. Working closely with the Survey's technical staff, scientists in related fields in other parts of government, in universities and research institutions, and in private industry, the Office of Research and Development is expected to become the focal point for gathering and disseminating up-to-the-minute information on scientific research activities in the fields of oceanography, geodesy, geophysics, photogrammetry, and cartography.

The Office of Oceanography will be responsible for a comprehensive program of oceanographic surveys, and a broad complex of related programs related to the sea as one of man's major environmental elements. This Office, which will comprise all technical oceanographic activities and all supporting facilities for such activities, is the framework upon which will be built an expanded program in the field of oceanography which is planned for the next ten years.

Admiral H. Arnold Karo, Director, U. S. Coast and Geodetic Survey, who directed the technical phases of the study which led to this reorganization has stated: "We in the U. S. Coast and Geodetic Survey look to the future with a confidence well supported by our legitimate pride in the Survey's outstanding accomplishments in more than a century and a half of dedicated service to science. The Survey has a well earned reputation for building solidly on solid foundations, with sound conservative progress. It has never feared to move into the future with plans and programs to meet tomorrow's needs. Now, as the world moves into the age of advanced science, the Survey is again preparing its staff and organization for the exciting tasks that lie ahead. The revised organization is the Survey's chart for the course of leadership it will travel."

Since its establishment in 1807, the U. S. Coast and Geodetic Survey has three times adjusted its course: First, under the program of the Survey's founder, Ferdinand R. Hassler, (Superintendent from 1807 to 1843) coastal waters and the wilderness of the early frontier were charted; second, under Benjamin Franklin's great grandson, Alexander Dallas Bache, (Superintendent from 1843 to 1867) the Survey was started on the road which stretched its work across the continent as the country and industry mushroomed in size and complexity; and third, under E. Lester Jones (Superintendent from 1915 to 1929) the main drive of the Survey was again reoriented, this time to carry the Survey's work into, and through, the first half of the twentieth century with its extraordinary growth in air traffic.

In a Department of Commerce release bearing the date of July 31, 1960, it was stated that one of the first projects of the new Office of Oceanography, headed by Captain Kenneth G. Crosby, is an oceanographic survey by the ship *Pioneer*, Captain William F. Deane, commanding, of an 8,000 square mile area northwest of San Francisco, between Point Reyes and Point Delgada and within 60 miles of the coast.

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Recommended Reading

"How to Teach Civil Engineering," *Engineering News-Record,* July 7, 1960, pages 21 and 22, deals with the third and final conference of a series organized by The Cooper Union and cosponsored by the American Society of Civil Engineers and the American Society for Engineering Education.

Then read "No Change Now in C.E. Training," *Engineering News-Record,* July 14, 1960, page 32, which gives the results—somewhat negative so far—of the conference sponsored by The Cooper Union, A.S.C.E., and A.S.E.E.

Next, read the editorial, "Educating Civil Engineers," *Engineering News-Record,* July 21, 1960, page 124, which pertains to the outcome of the conference referred to in the two paragraphs above.

Now Hear This

A new company, the AGA Corporation of America, has been formed, with the main office at 2013 Park Ave., South Plainfield, N. J., and the New York office in the Graybar Building, 420 Lexington Avenue. The Geodimeter Company, a division of AGA, has established a service and training center at Hadley Airport in South Plainfield, N. J.

On July 1, 1960, Bausch & Lomb Optical Co., Rochester, N. Y., will become known officially as Bausch & Lomb Incorporated. The new name, which was recently approved by company stockholders, recognizes the fact that B&L is not restricting its research and manufacturing interests to the field of optics alone.

A new index map of the United States has been published by the U. S. Geological Survey for the maps in the 1:250,000 scale topographic map series. This index is available without charge upon application to the Map Information Office, Geological Survey, Washington 25, D. C.

The Travelers Insurance Companies, Hartford, Conn., have issued a 32-page booklet, "The Dishonor Roll,"—The Travelers 1960 Book of Street and Highway Accident Data—which contains some pretty grim statistics, cartoons, etc., and *should* impress the reader with the necessity for driving carefully. The booklet is available from the companies or their representatives as long as the supply lasts.

A new, 11-page index of Bendix G-15 civil

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engineering programs is available. The index contains an extensive listing of applications prepared by G-15 computer users, and submitted to the Users' Exchange library at the Bendix Computer Division, through the G-15 Users' Exchange Organization. Programs developed by the Computer Division applications group are also listed. Programs in the following categories are represented: Traffic, surveying, earthwork, culverts and sewers, soils, interchange, bridges and piers, beams, columns, section properties, miscellaneous analysis, and hydraulics. Copies of the index will be mailed on request. Bendix Computer Division, 5630 Arbor Vitae Street, Los Angeles 45, California.

King V. Hostick, of Springfield, Illinois, a collector of Americana, recently discovered, in a small hamlet in the southern part of Virginia, a paper dated April 5, 1750, which is believed to be the plot of an original survey by George Washington and possibly one of his earliest projects.

The Army Map Service broke ground July 11, 1960, for a new $1.6 million Cartographic Engineering Building, due to be completed in the latter part of 1962, at a site near the headquarters of the A.M.S. at Brookmont, Maryland.

The American Title Association has moved from 3608 Guardian Building, Detroit 26, Michigan, to Premier Building, 1725 Eye St., N.W., Washington 6, D. C.

Because even Texans are human, it is not unreasonable to suppose that some of them are afflicted now and then with shingles. However, we are slightly surprised to learn that a lot of their shingles are breaking out all over with Texas. Shingles, Inc., Dallas, Texas, has brought out a line of aluminum shingles on each one of which there is an outline map of the State of Texas.

A new booklet on their complete line of "Readers & Magnifiers" is available free by writing Bausch & Lomb, Incorporated, Rochester 2, N. Y., and specifying Catalog I-103.

The Department of Defense has ordered 333 of Tellurometer's "Micro Distancer" outfits for the use of the Army, Air Force, Navy, and Marines.

C. L. Berger & Sons, Inc., 37 Williams Street, Boston 19, Mass., will supply information concerning a new type of plump bob with a spring loaded point.

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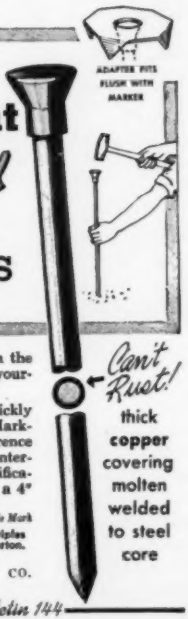

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(Continued from page 386.)

ocean bottom, the fish, and marine plant life around the Swan Islands, and planned to photograph the various instruments in use as they were lowered from the *Explorer*.

Drift bottles for use in studying ocean currents.

(Continued from page 391.)

an audience-participation demonstration of the Geodimeter in which actual field measurements of distances were accomplished.

Conference invitations were sent to ACSM members in an eight-State area surrounding Colorado. Each of the States was represented, including New Mexico, Utah, Wyoming, Nebraska, Kansas, Oklahoma, Colorado, and Oregon. This year Texas was included in the mailing, and there was a good representation from that State.

There is an urgent need for meetings of this kind, and apparently engineers are eager to hear about and discuss problems in the field of surveying and mapping.

It is of interest to note that most of those attending the conference were from the executive or policy-making levels of their organizations even though the program was designed to appeal to anyone in the surveying and mapping field.

All of the speakers made excellent presentations, but one of the highlights was Mr. Fennell's afterdinner talk, which elicited lively discussion by the audience, indicating a need for more positive direction in education in surveying and mapping.

Gene Harris

I don't care *what* color the rod is, plumb it!

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1961 ASP & ACSM Convention
Consecutive Meetings and Co-Exhibits

ASP Twenty-seventh Annual Meeting—March 19, 20, 21, 22
ACSM Twenty-first Annual Meeting—March 22, 23, 24, 25
Exhibits—March 21, 22, 23

OPERATION ENLIGHTENMENT

Have YOU a difficult project or problem involving the sciences of Photogrammetry and Surveying and Mapping? If so (and most of us do) you are sure to find an authoritative solution at the Shoreham Hotel, in Washington, D. C., the week of March 19 to 25, 1961. Assembled there will be the foremost authorities in our profession who are both willing and able to share—and exchange—their many talents.

The Technical, Plenary, Business, and informal sessions will develop a wide range of important papers and discussions including: the most recent instrumentation and developmental techniques in Photogrammetry; Modern Geodesy in action; the multifold problems involving the legal, ethical, planning, and associated programs in Property Surveys; major breakthroughs in surveying instrumentation and production equipment; Cartography programs in production, education, and planning; the role of Education in our sciences; outstanding Topographic projects inside and outside continental United States, including the requirements and the effect on present procedures and standards.

Complementing the technical program is a superlative exhibit that will feature the finest related equipment ever assembled. A number of choice spaces are still available. Please contact Exhibits Chairman Charles W. Schlager, 4500 Westbrook Drive, Kensington, Md., or the secretariats of ASP or ACSM.

REMEMBER—if it is enlightenment in our rapidly changing technological field you are seeking, you CAN'T AFFORD to miss this Convention.

Publicity Committee
1961 ASP-ACSM Convention

Notice—to ACSM Members and Officers:

ACSM Twenty-first Annual Meeting starts Wednesday of the convention week and runs through Thursday, and Friday, with required committee and executive sessions possibly extending through Saturday morning. Sequence is similar to the Nineteenth Annual Meeting in 1959, which is reverse to the 1960 meeting when ACSM started first. ACSM follows ASP this time. Dates for the ACSM 21st Annual Meeting are March 22, 23, 24, 1961. Divisions should summarize convention developments for presentation to the ACSM Annual Business Meeting which closes the Friday afternoon program.

Please make your plans and shape your programs accordingly.

JOHN M. MCALINDEN, *Chairman*
ACSM Twenty-first Annual Meeting

WALTER S. DIX
Executive Secretary, ACSM

MAPPING